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RESEARCH TRIANGLE INSTITUTE

FINAL REPORT

September 1977

Work Unit 4126I

RTI Project 44U-1358

Study to Develop a Damage Estimation System for In-House Studies

Prepared for

Defense Civil Preparedness Agency
Department of Defense
Contract No. DCPA01-76-C-0333

by

R. N. Hendry
R. O. Lyday, Jr.
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RESEARCH TRIANGLE PARK, NORTH CAROLINA 27709

RESEARCH TRIANGLE INSTITUTE

Operations Analysis Division
Management Information Sciences Department
Post Office Box 12194
Research Triangle Park, North Carolina 27709

DETACHABLE SUMMARY

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by

R. N. Hendry, R. O. Lyday, Jr., T. W. Della, and K. J. Reeves

for

Defense Civil Preparedness Agency
Department of Defense
Washington, D.C. 20301

under

Contract No. DCPA01-76-C-0333
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DCPA Review Notice

This report has been reviewed in the Defense Civil Preparedness Agency and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Defense Civil Preparedness Agency.

DETACHABLE SUMMARY

There is a continuing need for good planning whereby all resources available to local Civil Defense directors will be used effectively in countering the devastating effects of a nuclear attack. Analytical studies have not yielded convincing proof that this need will be satisfied by manual methods. An alternative or complementary approach to manual methods is a computer simulation for The Test and Evaluation of Local Operating Systems (TELOS) that has been under development for some time with various configuration changes in the past several years.

During the past year, RTI has continued to develop a countermeasures model called LEMOS as a part of TELOS. The original purpose of this project was to develop a means by which in-house DCPA analyses could be made of emergency operations, including communication for crisis relocation planning implementation.

As a result of a planning meeting with DCPA project monitors, the priority of effort on a communications model was reduced in favor of greater emphasis on integration under an executive routine for functional modules already developed. Moreover, the change from CDC to UNIVAC computation equipment at the Defense Civil Preparedness Computation Center (DCPACC) required a redesign and redevelopment of the executive control procedures. As a result, RTI redirected its efforts toward creating a new control main-line program, refining the file management system, and performing test runs on the LEMOS system.

The executive control procedures (GENEC) developed at DCPACC were never applied to the control of LEMOS modules. The procedures were dependent on the CDC operating system characteristics at DCPACC. Since DCPACC was installing a UNIVAC 1100/10 to replace the CDC equipment, it was necessary to plan and develop an executive control system compatible with the new UNIVAC system. However, the UNIVAC system was not installed at the time this need became apparent.

The main accomplishments during the contract period were the development of a prototype executive control for LEMOS (and for TELOS as well) and improved management of interconnecting files. The previous method of executive control employed a tape oriented system closely related to the CDC's operating system. The current program control module (DCPAMAIN) employs a series of CALL operations in an overlay fashion. The overlay structure approach in DCPAMAIN appears, after study, to be compatible with the UNIVAC 1100/10 at DCPACC. Therefore, all COBOL and FORTRAN programs at RTI's computation facility (TUCC), should be converted to operate on the UNIVAC 1100/10 without further major modification.

The relatively large number of files used by the LEMOS system requires special attention to the file management so as to minimize I/O's and their impact on running time and cost. There are seventeen potential program runs, and there are forty-one files that must be maintained during these runs. During the contract period, RTI attempted to minimize the total number of files used and the number used in each program run.

RTI recommends that the LEMOS system be converted from the IBM 370/165 at TUCC to the UNIVAC 1100/10 at DCPACC. After conversion, the following developmental tasks should be undertaken: determine detailed scenario input and output requirements; integrate other TELOS models (GENUA, LOCATE, ADS) and LEMOS under the same executive control; enable ADS to assess special CD resources and network link damage; coordinate processing between ADS and LEMOS/Operations Model to prevent misestimation of injuries and deaths; and develop an accounting monitor to debug the TELOS system and perform extensive testing to evaluate system capabilities.

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The research described in this document covers the integration of the Local Emergency Operating System (LEMOS) computer programs into a consolidated set of selectable program modules under control of a resident main line program. During the past year, RTI —> next page

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cont.> continued to develop this countermeasures model as a part of TELOS. The relatively large number of files used by the LEMOS system requires special attention to file management so as to minimize I/O's and their impact on running time and cost. RTI recommended that the LEMOS system be converted to operate in the UNIVAC 1100/10 operating system environment, and that it be tested extensively as a part of TELOS to evaluate local CD system capabilities.

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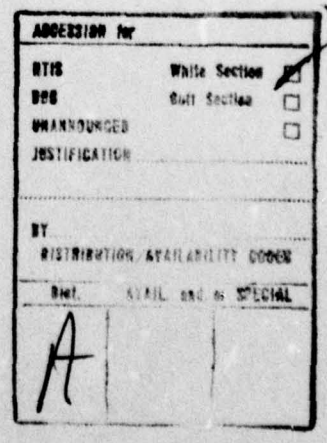

FORWARD

The research reported herein covers the Integration of the Local Emergency Operating System (LEMOS) computer programs into a consolidated set of selectable program modules under control of a resident main line program module. This work is sponsored by the Defense Civil Preparedness Agency (DCPA) under Contract No. DCPA01-76-C-0333 and Work Unit 4126I.

The authors express their indebtedness to Mr. Donald Hudson and Mr. James Jacobs of DCPA for their guidance during the study. The authors also express their appreciation to Mr. Edward L. Hill and to others in the Research Triangle Institute who supported this research.

ABSTRACT

A computer simulation for The Test and Evaluation of Local Operating Systems (TELOS) has been under development for some time. During the past year, RTI has continued to develop a countermeasures model called LEMOS as a part of TELOS. The main accomplishments during the contract period were the development of a prototype executive control module for LEMOS and improved management of interconnecting files. The executive control module employs a series of CALL operations in an overlay fashion. Special attention was given to file management so as to minimize I/O's, running time, and cost. RTI made several recommendations for continued effort on LEMOS and TELOS.

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I. BACKGROUND

A. Introduction

There is a continuing need for good planning whereby all resources available to local civil defense directors will be used effectively in countering the devastating effects of a nuclear attack. Because of the enormous complexity of local civil defense operations, analytical studies have not yielded convincing proof that this need will be satisfied by manual methods, even though efforts at local command and control exercises are commendable. An alternative or complementary approach to manual exercises is a computer simulation. This approach is embodied in a semi-automatic analytical system called TELOS. TELOS stands for The Test and Evaluation of Local Operating Systems and has been under development for some time with various configuration changes in the past several years. Figure 1 is a schematic of the overall system design. Scenario definition and performance evaluation are intended in large part to be accomplished by analysts through manual procedures. Zonal data preparation should not be automated until all data requirements have been adequately defined. Therefore, data preparation is now performed manually by developing a Master Status File (an enumeration of resources at the time a scenario begins). The executive control, attack, damage assessment, and countermeasures models all exist in various stages of development. Although none of these models are considered complete, they are approaching a point at which they will enable in-house DCPA analyses. In fact, one version of ADS has been used to assess damage in a study of several cities [Ref. 1]. However, the main TELOS system including countermeasures remains to be integrated.

During the past year, RTI has continued to develop LEMOS as a part of TELOS. The original purpose of this project was to develop a means by which

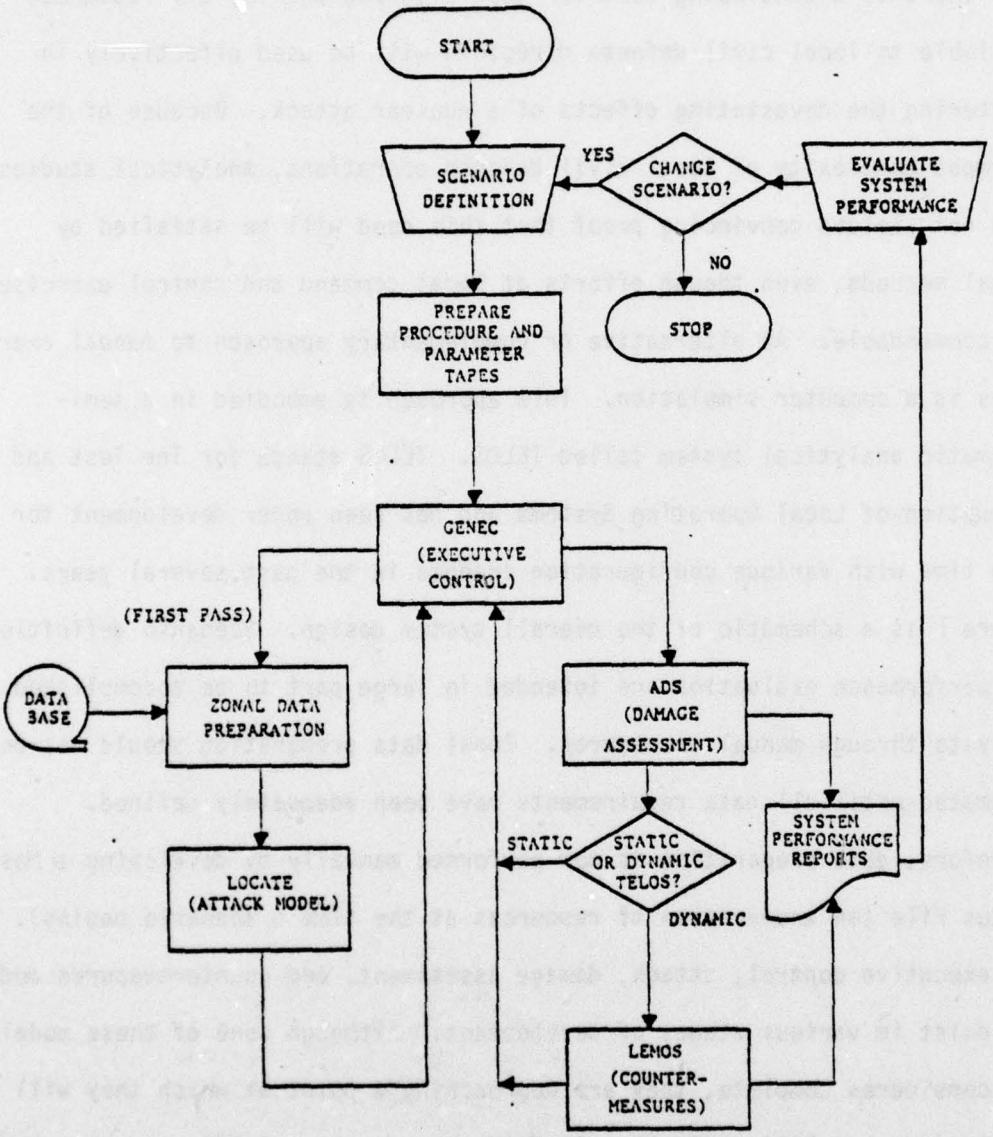

Figure 1. Overall TELOS System

in-house DCPA analysis can be made of emergency operations, including communications for Crisis Relocation Planning (CRP) implementation. Consequently, the work plan was oriented toward the development of a communications subsystem module capable of assessing communications support for both crisis relocation and trans-attack operations.

Under the concept of CRP, residents of areas having a high risk of receiving direct weapons effects from a nuclear attack are relocated to areas with a lower risk of receiving these effects. This type of planning specifies that the population relocation would be implemented in the face of international tensions which have implications of ending in war.

Major considerations in the development of such plans are the risk levels in each unit area, the geographic distribution or development of resource systems, and the command and control system(s) including communication networks. An analytic system is needed to analyze the planning parameters, especially requirements for communications for direction and control in the event a CRP is activated. Most of the host or reception areas to which the population at risk would be relocated are widely dispersed and contain a minimum of resources. These factors, along with the large variety and interactions between resource systems, argue for an analytic system capable of handling large quantities of data. The Area Damage Summary (ADS) System developed by DCPA and the Local Emergency Operation System (LEMOS) developed by RTI are expected to provide a basis for the TELOS analytic system. To utilize ADS and LEMOS effectively, compatible definitions are required by which state and local plans are interfaced with the description of target and relocation areas and their resources. Implementation of these plans by decision makers invokes demands for resource expenditures and means for communicating instructions and receiving status reports. The problems of

command and control in CRP's are compounded by the presence of attack effects.

As a result of a planning meeting with DCPA project monitors (Messrs. Donald Hudson and James Jacobs), the effort on a communications model was reduced in priority in favor of greater emphasis on integration under an executive routine of functional modules already developed. Moreover, the change from CDC to UNIVAC computation equipment at the Defense Civil Preparedness Computation Center (DCPACC) required a redesign and redevelopment of the executive control procedures. As a result, RTI redirected its efforts toward creating a new control main-line program, refining the file management system, and performing test runs on the LEMOS system.

B. TELOS Procedures

The system programs called TELOS was designed as a research tool to test and evaluate local operating systems concepts. Subsequently, three additional uses have been described: (1) as a countermeasure assessment aid for natural civil defense evaluations; (2) as a planning aid for local CD planners; and (3) as a training aid to simulate attack scenarios for local CD directors. Each of these additional roles would require inputs and outputs different from those described in current executive control procedures. In general, the overall TELOS description in Figure 1 is directed toward the research role. Detailed studies of changes to that system for non-research roles have not been undertaken, even though some consideration has been given to them in preparing the program module developed to date. More effort has gone into the static role involving the attack and damage assessment models than the dynamic role using LEMOS. The primary change in the system description presented in earlier reports is the replacement of GENEC with DCPAMAIN.

Briefly, the TELOS system functions under the control of a basic

scenario, through the use of an executive routine called DCPAMAIN (see section II). The local area (or zone) is described by configuring a local area from statistical data about local areas contained in a data base. The resources in the simulated area derived from the data base can be varied depending upon the scenario and special local considerations. Thus, a target model (GENUA) enables the interactive preparation of the Master Status File (MSF). Included in TELOS is an attack model which generates overpressure as well as thermal, prompt, and fallout radiation levels at various points over the entire local area. The Area Damage Summary (ADS) System relates the resources to the environmental effects generated by the attack model and describes the resulting damage in the MSF. The Local Emergency Operating System (LEMOS) responds with countermeasures to problems derived from an examination of both actual and potential resource damage, thus altering the state of local resources.

The TELOS system iterates between the countermeasures (LEMOS) and damage assessment (ADS) models, continuing through a number of time periods under control of the basic scenario (via DCPAMAIN). Manual evaluation of system outputs is contemplated at this time. A mechanized evaluation model may be needed to analyze the large amount of outputs as they apply to a particular role of TELOS. On the basis of this evaluation, controls for further iterations are determined and implemented in TELOS through the use of DCPAMAIN, and a new cycle begins. Throughout the course of the simulation, reports are generated to measure the status of the system under test as a basis for the evaluation of local emergency operations.

C. LEMOS Model

Figure 2 shows the major elements that make up the LEMOS model. The following paragraphs describe briefly each of the major elements which constitute LEMOS.

Organization of civil defense countermeasures to meet undesirable situations begins with the problem definition model. Each resource in the Inventory Status File is examined with respect to its damage state and environment. A set of problems is identified which requires that a countermeasure be conducted to solve or improve the prevailing situation. A counterpart of these problems is the availability of resources to implement proposed countermeasures. Shortage or damage to these resources, particularly injury to personnel, adds control and readiness problems to those already recognized as requiring remedial action. Availability of CD resources is defined by a resource matrix organized by land use or service function and resource type associated with each function. The output of the problem definition model is a Resource File and a Problem File containing four general classes of problems: control, readiness, damage control, and relief and rehabilitation. Records of two or more classes exist for each land-use entry within a unit area since control and readiness problems are always present. The objective of LEMOS is to resolve all of these problems.

The first function of the requirements model is to update service records and identify increased readiness and control problems. After updating, sufficient information is available to prepare alternative assignments. The requirements model has been written to include a table-lookup capability to generate resource requirements. The Service File is updated with respect to the status of teams by examining the Resource and the "new" Problem Files. For example, if a change due to injury, entrapment,

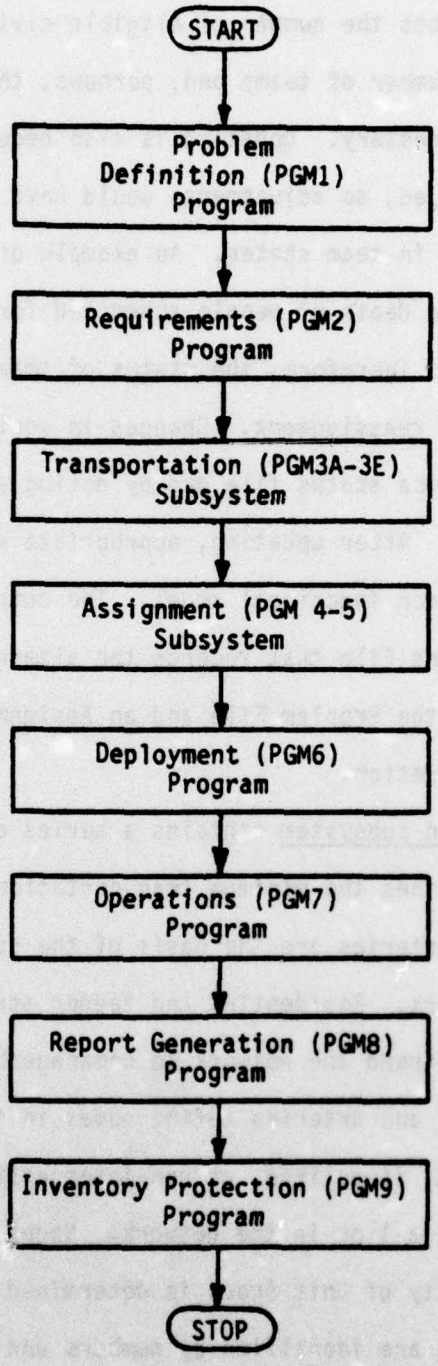

Figure 2. LEMOS Model

or other mishap reduces the number of eligible civil defense people, adjustments in the number of teams and, perhaps, their functions and state distributions are necessary. Updating is also necessary if the magnitude of a problem has decreased, so adjustments would have to be made in existing assignments and then in team states. An example of the need for updating in service status is the death of people scheduled for rescue while teams are enroute to the site. Therefore, the status of teams may change from active to inactive, pending reassignment. Changes in equipment or supply are made by updating the service status file and by noting any new increased readiness or control problems. After updating, appropriate records are selected for processing through each functional model. The output of the requirements model is an Operations File that records the alternative solutions to all problems defined by the Problem File and an Assignment File that records each function in each operation.

The transportion subsystem contains a series of programs shown in Figure 3 that determines the minimum transportation times between unit areas. Freeways and major arteries are the basis of the current development of the transportation network. Residential and feeder streets are not included as they unnecessarily expand the network to unmanageable proportions. Intersections of highways and arteries define nodes in the network. Additional nodes could be added, if desired, at non-intersection points. The segment between two nodes is a link in the network. Nodes are identified by unique numbers. Connectivity of Unit Areas is determined by the occurrence of equal node numbers. Links are identified by numbers and names. Link identification is not involved computationally in the current computerized transportation model; it is used only to aid in creating the Links File data base. The transportation network is described by the Links File. The data in this

Figure 3. Transportation Subsystem

file is used to create the matrix of distances between directly linked nodes in a unit area network.

The computerized Transportation Subsystem computes the path of minimum travel time between all unit areas and creates the TVLREF file. The problems are defined in unit areas which are separated in terms of distances, and the conversion from distance to travel time is made by assuming a speed of 45 miles per hour. The input data to the computer model consist of two files (the Links File, which describes each unit area network in its initial state, and a Control File, which identifies the numbers of the unit area networks selected for processing). The computer program has been written to accommodate unit area networks containing a maximum of 75 nodes each and a zonal network containing a maximum of 400 unit areas. It has been tested on a network of 8 unit areas containing from 6 to 26 nodes.

There are two major steps in the model. The first is a "one-for-all" step that computes shortest paths between all nodes in a unit area network and the distances between directly linked unit area networks. This step uses the Link and Control Files previously mentioned. The second step uses the Basic Operating Situation (BOS) of each unit area from the Resource File to alter these distances and, then, to compute the shortest paths between all unit areas. The second step can be repeated as often as necessary as BOS changes occur over time in a given scenario. Both steps use Floyd's algorithm to compute the shortest paths between all nodes. In addition to Floyd's algorithm, (which solves for all shortest paths from all nodes in a network to either one or all other nodes), another efficient method is Dijkstra's algorithm, which solves for either the shortest path between two specified nodes or the shortest paths from a specified origin to all destinations.

The output from this subsystem is a Travel Reference (TVLREF) File that quantifies the travel time between unit areas after considering the damage and operating environments affecting the transportation system in the zone of operations.

The assignment subsystem depicted in Figure 4 uses the operations and initial Assignment File from the requirements model and the Travel Reference File from the transportation subsystem. The number of teams and the average time each team requires to implement each operation are used, subject to constraint, to determine assignments for all teams under the jurisdiction of a specified control point. This allocation procedure [Ref. 2], an adaptation of an efficient algorithm developed by RTI [Ref. 3], assigns resources to alternative programs. Demands not assigned are retained for subsequent allocation of unassigned resources in later periods. Provision has been made to permit externally assigned priorities to override internally assigned priorities. After all assignment decisions have been made and new and old operations records have been combined, the evaluation procedure enters the operational phase for the deployment of resources and the execution of mission assignments.

Planning for team and supply distribution over the network of lines and links is accomplished in the deployment model. A minimum Route (TVLREF) File was generated in the transportation subsystem for all moves between admissible origins and destinations within a network. Selected minimum paths consider network problems (e.g., radiation and blocked streets) evident in the current period. This Route File is the source of all movement time entries in trip records. Resource availability and functional capability are the two main criteria for generating movement requests. If the environment prevents functional performance or resources are not available in a specific

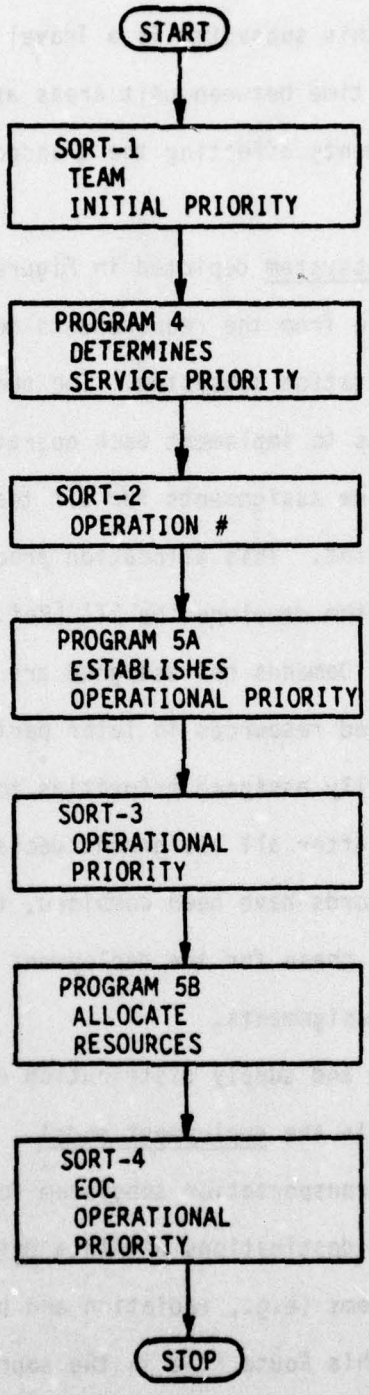

Figure 4. Assignment Subsystem

area, neighboring areas are searched to establish minimum time moves that resolve these problems. Searches are conducted in order of operational priority and two trip records are generated. The first is used to subtract resources at the origin, and the second is used to add resources at the destination. If arrival times have not been reached at the end of the current period, the resources are placed in an "in-transit" status. The Trip File is the primary output of the deployment model.

Normally, deployment is made possible at the beginning of the operations phase at rates specified by two trip records generated in the deployment model. These two records are sorted into origin and destination locations in a sorting operation between the deployment and operations models. Operations records are processed in the operations model by priority in the presence of assignment records organized by area, operation number, and land use. Available resources are expended in exchange for problem resolution. Changes in resource states are recorded in the Benefit, Problem, and Resource Files. The operations model has not been completed with respect to processing all functions. The completion of this model must be coordinated closely with respect to the completion of the ADS special resources damage assessment for population deaths and injuries. This coordination is deemed essential to the proper execution of TELOS and should be undertaken in the next contract period.

The Benefit File is used in the report generating model to describe benefits, readiness, and team effectiveness. The changed Resource and Problem Files are input to the final step in the countermeasures model before redefining the resource status and recording the vulnerability in the Inventory Status File. During the reporting period, a report generator uses two files. The first is a Performance File generated in the operations

model. It contains team performance, population benefits, and readiness information. The second file contains historical operations data from previous periods. Data from these two files are processed and the cost-benefit measures are developed and displayed in two reports, the Team Effectiveness Report (Figure 5) and the Benefit Report (Figure 6). In addition, the program has the capability of plotting data from the two reports to allow visual scanning for significant changes over time. The plotting procedure can plot four (4) data sets for each time period. An example of this form of output may be seen in Figure 7. Four different sets of plots may be produced displaying the values of 16 data elements.

As the countermeasures model is integrated with the evaluation model, additional data requirements are likely to evolve. If so, then this report generating procedure probably will be altered to meet these new needs.

The final module in the LEMOS series of programs is called the inventory protection model. Where the people are located (e.g., in single family residential units or NFSS shelters) determines the protection level or, conversely, the vulnerability level of people. People are loaded into shelters, and inventory records are prepared according to the control policy and posture constraints prevailing at each location. This model uses the Problem and Resource Files from the operations model to update the status of resources in the Master Status File (MSF) from the damage assessment (ADS) model. Three files (Problem, Resource, and MSF) are manipulated to update the MSF file. The MSF file is identified here to emphasize the significant aspects of this interface. If area data remains unchanged, the file is transferred directly to the updated file; structural data and area situations are generated from the previous MSF and Problem Files; personnel records are generated largely from the Problem File; resource records are generated from

DATE = 05-15-72

TEAM EFFECTIVENESS REPORT

PERIOD = 1 TIME = 1.0 DURATION = 1.0 ZONE = 1 EOC = 1 AREA = 1

TEAM NO.	TEAM LOSSES	TEAM SURVIVING	TEAM-HOURS TOTAL	TEAM-HOURS GAIN/LOSS	TEAM-HOURS DEMAND	PERCENT S	C	P	A	M	I	O	R	AVAIL.	REL.	UTIL.	EFFECT.
2	63	104	104	3	327	.301	.284	.425	.850	.046	.085	.014	.000	.622	.981	.911	.556
12	112	499	499	-44	131	.000	.852	.148	.209	.014	.565	.212	.000	.817	.788	.283	.182
15	5	93	93	-5	1023	.925	.050	.035	.550	.000	.351	.100	.000	.950	.901	.561	.480
21	24	381	381	5	58	.000	.981	.019	.149	.790	.037	.025	.000	.941	.976	.153	.141
28	1	116	116	32	421	.599	.237	.164	.820	.043	.079	.056	.000	.990	.942	.912	.850
33	87	242	201	-87	975	.536	.156	.308	.000	.755	.202	.043	.000	.700	.957	.791	.530
34	230	368	344	-180	160	.000	.813	.197	.000	.380	.478	.142	.000	.601	.858	.441	.227
41	55	283	283	-42	0	.000	1.000	.000	.000	.000	.913	.087	.000	.864	.913	.000	.000
46	392	147	147	-24	98	.062	.715	.223	.456	.020	.186	.338	.000	.273	.662	.718	.130
47	191	501	501	-191	677	.246	.438	.316	.444	.148	.158	.249	.000	.725	.750	.787	.423

Figure 5. Team Effectiveness Report

DATE = 05-15-72

BENEFIT REPORT

PERIOD = 1 TIME = 24.0 DURATION = .5 ZONE = 1

AREA NO.	TOTAL POP.	PERCENT NORM	PROB	LOST	PRIOR STATE RWB	RDY	COST	CURRENT STATE RWB	RDY	COST	BENEFITS ADDED RWB	S	L	V	H	RWB PRICE	POTENTIAL BENEFITS ADDED RDY	S	L	V	H	RDY PRICE
1	15586	.65	.29	.06	1.000	.000	0	.674	.273	0	-.326	-.05	-.40	-.36	-.36	0	.273	1.00	.04	.03	.02	0
2	10000	1.00	.00	.00	1.000	.000	0	1.000	1.000	0	.000	.00	.00	.00	.00	0	1.000	1.00	1.00	1.00	1.00	0

FOOTNOTES. RWB = RELATIVE WELL BEING RDY = READINESS COST = TEAMHRS S = SURVIVORS L = LABOR J = JOBS H = HOUSING PRICE = THRS/BEN

Figure 6. Area Benefit Report

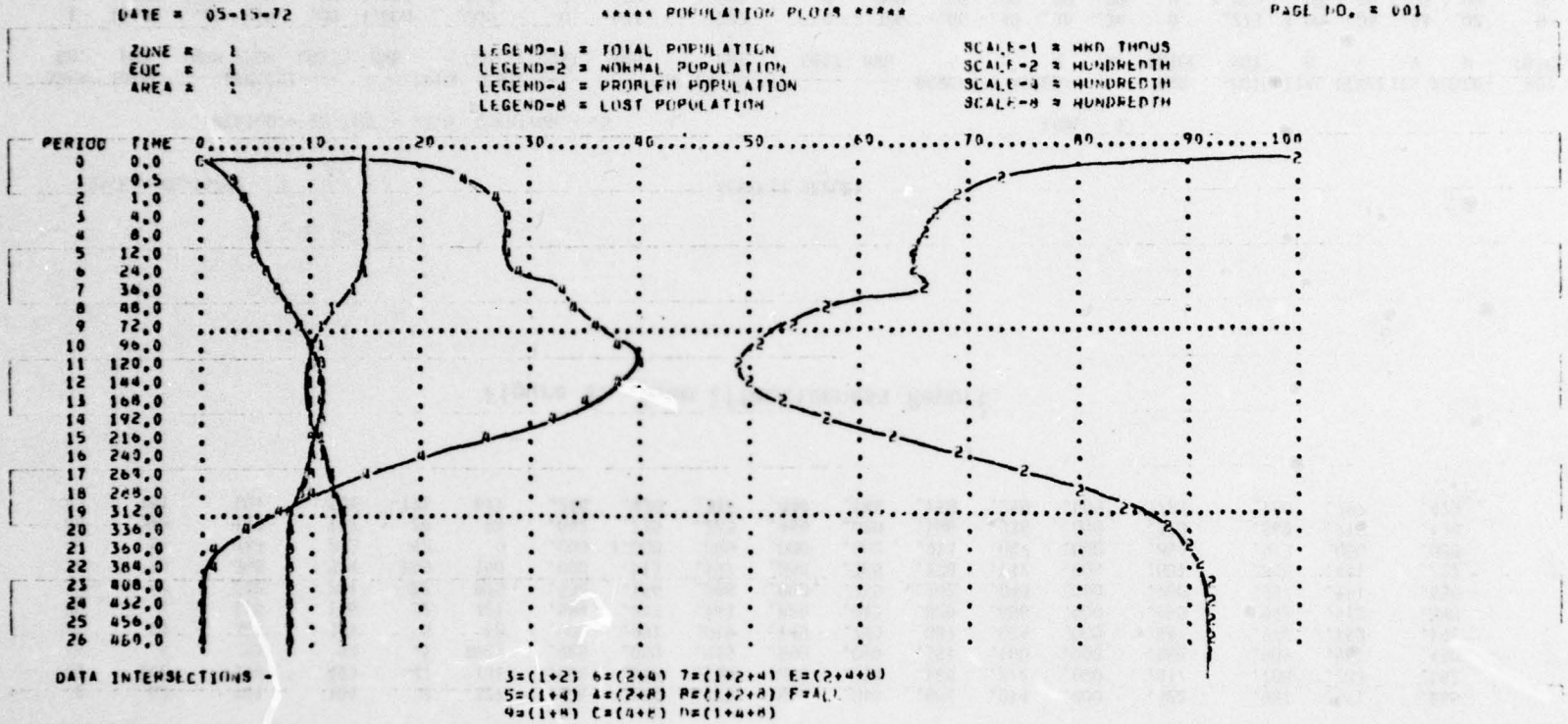

Figure 7. Population Plots

both the Resource and the Master Status files; and shelter space records are transferred from the the MSF. The final function of this model is to fill shelter spaces according to the control pokicy and to record the protection factors for the occupants.

At this point in the evaulation, one pass has been completed through the countermeasures model by taking the Master Status File from the damage assessment (ADS) model and returning an equivalent file. The MSF was modified to reflect civil defense countermeasures during the specified time interval. In the course of planning and executing the specified countermeasures, a number of files were created, modified, and retained for the next process period. Processing continues until the number of time periods required by the system control model terminates the simulation. A large number of printout options provided within the LEMOS and ADS yields a running description of system performance. Output data may be processed at the conclusion of each pass or at the time of termination.

Analysis of reports produced by successive periods of performance is the basis for evaluations of the effectiveness of local operations regardless of which of the following roles TELOS is playing:

(1) research,

(2) national assessment,

(3) planning, or

(4) training.

As stated earlier, the primary development during the past year is the creation of a new executive control mainline program (DCPAMAIN) to replace GENEC, which was described in last year's report [Ref. 4]. This development is described in Section II of this report and introduces the basis for develment of DCPAMAIN and the file management changes presented in Section III.

II. LEMOS SYSTEM CONTROL

A. Introduction

The GENEC executive control procedures developed at DCPACC were never applied to the control of LEMOS modules. The procedures were dependent on the CDC operating system characteristics at DCPACC. Since DCPACC was installing a UNIVAC 1100/10 to replace the CDC equipment, it was necessary to plan and develop an executive control system compatible with the new UNIVAC system. However, the UNIVAC system was not installed at the time this need became apparent. Therefore, RTI designed an executive control system on IBM equipment based on overlays and calls that were known to be relatively compatible with the UNIVAC system. The following sections will describe the overlay procedures in general, and the specific procedures on the IBM and UNIVAC equipment.

B. Program Overlaying and Calls

The sequence of program module execution requires a method to specify module selection. The particular method employed depends upon features available on the computer designated by the user. The previous method of executive control employed a tape oriented system closely related to the CDC's operating system. The current program module control system employs a series of CALL operations in an overlay fashion.

If a set of programs requires more memory area than is available, as is the case with TELOS and LEMOS, then a method must be found to reduce memory area. An "overlay" procedure permits a program to run on a computer when this is the situation. "When a section of computer code is loaded into a central memory area that was previously allocated to another section of the same executing program, the process is called "overlaying" [Ref. 5]. An initial or "main" part of the program is loaded into core memory; the

remainder is maintained in peripheral storage (usually direct access). During program operation, instructions are executed to cause part (or all) of the core memory to be overlayed by specified program sections from off-line storage. In a typical system, an overlay tree can be specified as shown in Figure 8. A base or root segment is defined by the programmer and remains in core throughout the running of the program. One of the first level overlays A, B, or C may occupy the area just beyond the end of the root segment. Assuming that the branch A-E-M is operating, then E is just beyond A, and M is just beyond E. The programmer defines the beginning and ending of each segment and its position in the tree structure. The language processing system will organize the object modules into a structure residing in peripheral storage from which the necessary overlays are loaded at execution time. If the operating system has "virtual memory" capabilities, then overlaying is completely automatic.

The "calls" in the main program initiate the overlaying process and indeed control the sequencing of overlays as needed by the scenario. "Looping" of the calling sequence enables the system to repeat the required number of times. The overlay structure for LEMOS is simple and will be described in the next section.

C. Executive Control Procedures

Figure 9 contains a copy of the linkage editor output from the IBM run establishing the overlay structure of the LEMOS system procedure. As can be seen from this description, a general sorting procedure called DCPASORT has been added to the program set in addition to the resident main module (RESMAIN). Programs NGM3A through NGM3E are a set of programs accomplishing the transportation or minimum route determination function. The report generator, NGM8, was not included but can be added when needed. Otherwise,

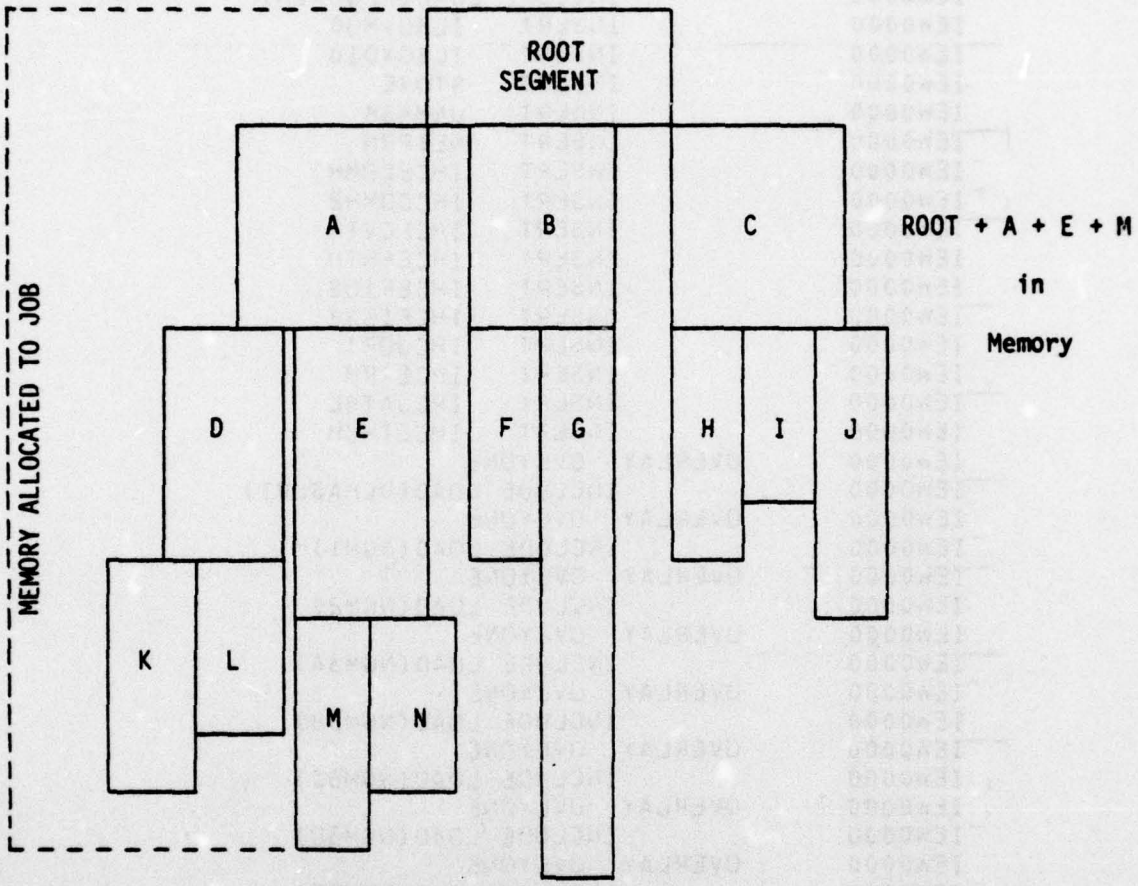

Figure 8. An Overlay Tree Structure

```
F88-LEVEL LINKAGE EDITOR OPTIONS SPECIFIED MAP,LIST,LET,OVLY
          DEFAULT OPTION(S) USED -  SIZE=(100352,16384)
IEW0000              INCLUDE LOAD(RESMAIN)
IEW0000              INSERT   ILBOVM00
IEW0000              INSERT   ILBOXD10
IEW0000              INSERT   STORE
IEW0000              INSERT   UNMASK
IEW0000              INSERT   NETPRN
IEW0000              INSERT   IHCECOMH
IEW0000              INSERT   IHCCOMH2
IEW0000              INSERT   IHCFCVTH
IEW0000              INSERT   IHCEFNTH
IEW0000              INSERT   IHCEFIOS
IEW0000              INSERT   IHCFIOS2
IEW0000              INSERT   IHCUOPT
IEW0000              INSERT   IHCERRM
IEW0000              INSERT   IHCUATBL
IEW0000              INSERT   IHCETRCH
IEW0000       OVERLAY  OVLYONE
IEW0000              INCLUDE LOAD(DCPASORT)
IEW0000       OVERLAY  OVLYONE
IEW0000              INCLUDE LOAD(NGM1)
IEW0000       OVERLAY  OVLYONE
IEW0000              INCLUDE LOAD(NGM2)
IEW0000       OVERLAY  OVLYONE
IEW0000              INCLUDE LOAD(NGM3A)
IEW0000       OVERLAY  OVLYONE
IEW0000              INCLUDE LOAD(NGM3B)
IEW0000       OVERLAY  OVLYONE
IEW0000              INCLUDE LOAD(NGM3C)
IEW0000       OVERLAY  OVLYONE
IEW0000              INCLUDE LOAD(NGM3D)
IEW0000       OVERLAY  OVLYONE
IEW0000              INCLUDE LOAD(NGM3E)
IEW0000       OVERLAY  OVLYONE
IEW0000              INCLUDE LOAD(NGM4)
IEW0000       OVERLAY  OVLYONE
IEW0000              INCLUDE LOAD(NGM5)
IEW0000       OVERLAY  OVLYONE
IEW0000              INCLUDE LOAD(NGM6)
IEW0000       OVERLAY  OVLYONE
IEW0000              INCLUDE LOAD(NGM7)
IEW0000       OVERLAY  OVLYONE
IEW0000              INCLUDE LOAD(NGM9)
IEW0000              NAME  DCPAMAIN(R)
```

Figure 9. Linkage Editor Output for Overlay Structure

programs 1 through 9 in the LEMOS series (as described in Figure 2) are identified as NGM1 through NGM9 in the overlay.

The current listing of the executive module using this structure is contained in Appendix A. The resident main program has been used to test the procedure.

The overlay system was demonstrated by making several runs on the IBM 370/165 computer at the Triangle Universities Computation Center (TUCC). Figure 10 shows the control statements for a run of the Transportation Subsystem. Other runs with similar control statements were made on the LEMOS set of programs. The control data cards for these runs is illustrated in Figure 11. Each card calling for a program execution is followed by a second record containing parameters used to control that program. These tests were not exhaustive, nor did they attempt to determine resource accountability between inputs and outputs for each program. Further testing should include an accountability report between each program to aid in the tracking of resources between programs. This report will reduce the manual effort devoted to this time consuming task required to verify the accuracy of the simulation procedures. However, the results of these test runs confirm the feasibility of this approach. Finalization of DCPAMAIN should await more complete testing of the series after conversion to the UNIVAC 1100/10 at DCPACC.

At present, the program sequence is determined by a series of control cards read by the main program. Run switches on the date cards select the program modules required for execution. RTI recommends that this procedure be modified by converting this record set into a table which can be interactively changed prior to system runs. Moreover, these interactive sessions should be planned as a part of the scenario and controlled by

```
//  EXEC PGM=DCPAMAIN,REGION=500K
//STEPLIB DD UNIT=DISK,DISP=SHR,
// VOL=SER=RTIOCD,DSN=RTI.C44.P03168.RNH.DCPALIB
//SYSPRINT DD SYSOUT=A
//SYSOUT DD SYSOUT=A
//FT03F001 DD SYSOUT=A
//FT01F001 DD UNIT=DISK,DISP=SHR,
// VOL=SER=RTIOCD,DSN=TEST.FT
//FT30F001 DD UNIT=DISK,DISP=SHR,
//  VOL=SER=RTIOCD,DSN=TEST.NETLIST
//FT51F001 DD UNIT=DISK,DISP=SHR,
// VOL=SER=RTIOCD,DSN=TEST.LINKS
//FT53F001 DD UNIT=DISK,DISP=SHR,
//  VOL=SER=RTIOCD,DSN=TEST.PATHS
//FT55F001 DD UNIT=DISK,DISP=SHR,
//  VOL=SER=RTIOCD,DSN=TEST.FINAL
//FT60F001 DD UNIT=DISK,DISP=SHR,
//  VOL=SER=RTIOCD,DSN=TEST.TEMP60
//FT61F001 DD DISP=SHR,DSN=RTI.C43.P05230.JWD.TEST.RESOURCE
//FT70F001 DD UNIT=DISK,DISP=(,DELETE),
// SPACE=(TRK,(10,10),RLSE),
// DCB=(RECFM=VBS,LRECL=1608,BLKSIZE=11260),
// DSN=&&TEMP70
//FT71F001 DD UNIT=DISK,DISP=(,DELETE),
// SPACE=(TRK,(10,10),RLSE),
// DCB=(RECFM=VBS,LRECL=1608,BLKSIZE=11260),
// DSN=&&TEMP71
//FT80F001 DD UNIT=DISK,DISP=(,DELETE),
// SPACE=(TRK,(10,10),RLSE),
// DCB=(RECFM=VBS,LRECL=1608,BLKSIZE=11260),
// DSN=&&TEMP80
//FT81F001 DD UNIT=DISK,DISP=(,DELETE),
// SPACE=(TRK,(10,10),RLSE),
// DCB=(RECFM=VBS,LRECL=1608,BLKSIZE=11260),
// DSN=&&TEMP81
//FT91F001 DD UNIT=DISK,DISP=SHR,
//  VOL=SER=RTIOCD,DSN=TEST.A2BOUN
//FT92F001 DD UNIT=DISK,DISP=SHR,
//  VOL=SER=RTIOCD,DSN=TEST.BOUN2B
//FT93F001 DD UNIT=DISK,DISP=SHR,
//  VOL=SER=RTIOCD,DSN=TEST.DIST
//FT94F001 DD UNIT=DISK,DISP=SHR,
//  VOL=SER=RTIOCD,DSN=TEST.TVLREC
//SYSIN DD *
```

Figure 10. Job Control Language Statements for Transportation Subsystem Tests

```
         1       EXEC PGM-1
02-14-751T350250000501105020020500000000000000000000000000000000000200100121
         2     EXEC PGM-2
01-17-723150024000050312000000000000000000000000000000000000000000000500000000
         4       EXEC PGM-4
02-14-751T350250000501105020020500000000000000000000000000000000000200100421
         5     EXEC PGM-5
04-07-721T100240000050300000000000000000000000000000000000000000001100020520
         6     EXEC PGM-6
04-07-722T100240000050300000000000000000000000000000000000000000001100020620
         7     EXEC PGM-7
05-28-771T350250000501105020020500000000000000000000000000000000000200100121
         8    EXEC PGM-8
05-28-771T350250000501105020020500000000000000000000000000000000000200100121
         9    EXEC PGM-9
05-28-771T350250000501105020020500000000000000000000000000000000000200100121
/*
```

Figure 11. Control Records for Trial Run

another table in which the number of time periods (loops) in each system run will be stated explicitly. In this concept, the scenario is managed interactively. At this time it is apparent that under this concept the person responsible for the interactive session should have some intermediate outputs which will enable the optimum usage of the run controls. However, this need has not been studied sufficiently to recommend specific intermediate output requirements.

A review of Figure 4 shows the need for various sort orders for files between program execution. The DCPASORT program described in Appendix B was created to provide a highly flexible method by which any of the files may be sorted within the system context.

While the resident main module in the overlay structure, called DCPAMAIN, was created on the IBM 370/165, no unwarranted effort will be required to convert the control procedures operational at the Triangle Universities Computation Center (TUCC) to the UNIVAC system operational at DCPACC. This problem is addressed in the next subsection.

D. Conversion to the UNIVAC 1100/10 Computer

The LEMOS system was implemented on the IBM 370/165 located at TUCC. The total package of programs requires a large number of files and many executable "steps" on the IBM computer.

The conversion of the LEMOS system to the UNIVAC 110/10 computer appears to be quite simple with the @ASG and the @USE executive commands being used specifically to define the files. The @ADD command can be used to evoke a series of @ASG's, @COB's, @XQT's, and @MAP's to create and merge the program elements into executable absolute modules and then execute the proper module. Other @ADD commands are also used to supply run parameters.

Since the UNIVAC ASCII COBOL compiler system also contains all the

space economizing elements utilized in the development of the LEMOS programs (such as the overlay and COPY features), no significant program modifications are envisioned in the conversion process.

III. FILE MANAGEMENT

A. General

The relatively large number of files used by the LEMOS system requires special attention to file management so as to minimize I/O's and their impact on running time and cost. There are seventeen potential program runs, and there are forty-one files that must be maintained during these runs. During the contract period, RTI attempted to minimize the total number of files used and the number used in each program run. Moreover, each program was examined with the view of incorporating some of the File and Working Storage Sections in a Library (DCPALIB) rather than in each program. Communication between programs is discussed in the next subsection and a concise report on file names and descriptions are described in the last subsection.

B. Interprogram Communication

Two types of communications occur between programs. Type one is referred to as control data and is resident in the main program. Type two is a file record that is read into or written from working areas within the program. Changes to values in fields within this record is the most common. Either of these types of communications may be displayed at a CRT or printed as user information. Type two communications may be further subdivided into those which pass between programs within a single pass and those which transmit information between passes. The former are considered more transitory, and in some instances, permit the same file identity to be used more than once in one simulated time period.

Figure 12 shows the current input-output relationships between LEMOS files and the programs which use them. While the present file identities are adequate, it is evident that further reductions in the number of

DDNAME	Description	1	2	3A	3B	3C	3D	3E	4	5A	5B	6	7	8A	8B	8C	8D	9
Cobol																		
FILE1	PROB1	I										0						I
FILE2	MASTER1	I																I
FILE3	PROB2	0	I															
FILE4	RESOURCE1	0	I									I	I					
FILE5	MASTER2																	0
FILE6	REFERENCE		I									I	I					
FILE12	ORGN		I															
FILE13	SERVICE1		I									0						
FILE15	OPS1		0						I									
FILE16	PROB3		0						I									
FILE19	SERVICE2		0					I			I							
FILE20	ASGN1		0					I	0		I							
FILE21	ASGN2		I					0	I									
FILE22	TVLREF							I				I						
FILE23	OPS2								0			I						
FILE25	TRIP											0	I					
FILE26	ASGN3									0		I						
FILE27	ASGN4											0						
FILE31	HISTORY											0						
FILE32	PERFORMANCE											0				I		
FILE34	PLOT1															I		
FILE35	PLOT2															0	0	
FILE36	BENEFITS															0	I	
FILE44	RESOURCE											0						I
Fortran																		
FT01F001	SYSIN		I															
FT03F001	SYSOUT=A																	
FT30F001	NETLIST		0		I		I		I									
FT51F001	LINKS		I															
FT53F001	PATHS		0		I													
FT55F001	FINAL						0		I									
FT60F001	WORK																	
FT61F001	RESOURCE							I										
FT70F001	WORK					W			W									
FT71F001	WORK					W												
FT80F001	WORK					W			W									
FT81F001	TEMP					W												
FT91F001	A2BOUN					0		I										
FT92F001	BOUN2B					0		I										
FT93F001	DISTANCE						0		I									
FT94F001	TVLREF							0										

Figure 12. Program-File Management Relationships

identities can be made with some gains in off-line storage space. However, changes to obtain these marginal gains would be somewhat premature. Since the prototype TELOS system has not been tested, such refinement should wait until LOCATE, ADS, and LEMOS are placed under control of the DCPAMAIN described in Section II.

The field descriptions of the type one communications (scenario or DCPAMAIN control) are described in Appendix C. Files identified in Figure 12 are described briefly in the next section to convey to the reader the type of information transmitted in interprogram communications.

C. File Descriptions

Figure 12 identifies all files used by name code or acronym (DDNAME); however, the descriptions in this section will be identified by the basic name in the description column. The following files are described briefly in subsequent paragraphs. More specific definitions of fields in these records are contained in Appendix D.

- Reference (REFERENCE)
- Master Status (MASTER1-2)
- Problem (PROB1-3)
- Resource (RESOURCE1-2)
- Organization (ORGN)
- Service (SERVICE1-2)
- Operations (OPS1-2)
- Assignment (ASGN1-4)
- Trip (TRIP)
- History (HISTORY)
- Performance (PERFORMANCE)
- Plot (PLOT1-2)
- Benefits (BENEFITS)
- Links (LINKS)
- Travel (TVLREF)

The Reference File contains a series of tables which represent basic reference material (on operations, functions, and teams) required to quantify the simulated operations. An Alternative Table produces a set of alternative operations given a specific problem. The Operations Table

defines the specific functions which constitute the operation. A Function Table indicates the teams which can perform that function together with their relative efficiency. The characteristics of each team are contained in the Team Table, which along with the Work Table, enables the user to compute team-hour and resource requirements for functional performance to resolve problems. This file may be modified at the beginning of a simulation, but should not be changed during the time frame of the scenario.

The target model is contained in the Master Status File (MSF) in terms of area, structures, shelter, people, and other special resources. Each of these elements is classified by types and status. Quantities in the MSF record fields are changed in the Area Damage System (ADS) model to reflect target degradation. The object of the LEMOS model is to upgrade resource states using various functional countermeasures, or at least to prevent further degradation by fire and fallout. This file is a primary communication vehicle between ADS and LEMOS and between time periods. At the present time, ADS has not been modified to process the special resources portion of the MSF.

When LEMOS receives the MSF from ADS, it redefines the target in terms of two files, namely, the Problem File and Resources File.

The purpose of the Problem File is to define explicitly problems by unit area which must be resolved by the available countermeasures. Four general problem types are recognized: control, readiness, damage, and relief and rehabilitation. The objective of local operations is to resolve each of these problems as soon as practicable.

The Resource File quantifies the resources by unit area and provides a means for accounting for the essential elements of the MSF during countermeasure processing. Emphasis is placed on tracking personnel and CD teams.

After both the Resource and Problem files have been modified during the course of processing by the LEMOS system, a revised MSF is generated in the Inventory Protection Program (PGM9) and returned to ADS for new damage estimation as a result of more weapons, fire spread, or fallout.

An Organization File has been introduced as a part of the system, but virtually no use is made of it in the absence of a communication model. The purpose of this file is to assign areas and teams to specific Civil Defense organizational structures. Since communication is considered perfect and without any capacity constraints, this file does not serve a particular purpose at this time.

The Service File is required to maintain information about the teams and the services to which the teams belong. It is used in the Requirement Program (PGM2) to define readiness problems. The status of each team is determined in the Operations Program (PGM7). This represents a primary feedback on the status of Civil Defense teams.

From the Requirements Program, two files (Operations and Assignment) relay information to the Assignment Subsystem about viable problem solutions. The Assignment Subsystem is designed to select from among three alternatives the specific operations to be undertaken later in the Operations Program.

The Operations File contains a record for each selected operation in terms of the specific functions needed to resolve the problem. In addition, this record contains information about quanitities, start time, benefits, priorities, and related subjects.

Each function is represented by a record in the Assignment File on which the operation is identified, the number of teams assigned, the start time determined, and the amount of effort expressed in team-hours to produce

the desired result.

Where movement of resources (including people requiring aid, or CD teams and material to provide aid) are required, trip records are prepared giving origin and destinations as well as start and arrival times. Two records are prepared in the Deployment Program (PGM6), one for the unit area in which the move originates, and the second for the unit area in which the move terminates. After sorting between Program 6 and 7, these records are used to subtract resources from one area and to add another area to accomplish the deployment. The Trip File contains enlarged records. The trip record merges the assignment record with operation and trip data to minimize the problem of matching trips to assignments and operations.

The assignment or trip records are completed in the Operations Program (PGM7) by expending resources and deriving benefits. These transactions are recorded on the assignment records and, if desired, retained for historical analysis. All retained assignment records are contained in the History File. In most cases, the History File is not retained. However, benefits and team readiness data is retained in the Performance File and becomes the basis for report generation.

Performance data from the Performance File is analyzed in the Report Generator and tabular Benefit and Readiness Reports prepared in the Report Generation Program (PGM8). Values of key performance measures are retained from these reports in the Plot File for time plots at designated breaks in the scenario or Benefit File. Normally, these breaks occur when interactive sessions are planned to evaluate intermediate results and, perhaps, change priorities, prohibitions, or limitions used to control the scenario.

Two significant files have not yet been described. They are the Links File and Travel Reference File and, respectively, are used as input to and

output from the Transportation Subsystem. They are noted among the FORTRAN files at the bottom of Figure 8. While other FORTRAN files are used in the Transportation Subsystem, they are used as working files between programs within it. The FORTRAN Resource File (FT61F001) is also the COBOL Resource1 File (FILE4) and the FORTRAN TVLREF File (FT94F001) is also the COBOL TVLREF (FILE22). Using these renaming conventions, the Transportation Subsystem is integrated into the LEMOS system.

The Links File contains information about the highway system by which unit areas are linked and over which resources are moved. The damage assessment system does not process this file at the present time. However, provision should be made at a later date to determine damage to the highway network (particularly to bridges in it). Nevertheless, some consideration is given to weapons effects by using the Basic Operating Situation (BOS) designations from the Resource File. The analysis of the transportation network by Floyd's algorithm leads to the preparation of the Travel Reference File containing measures of average travel time between all origins and destinations in terms of unit areas. These reference travel time values are used to select assignments in the assignment subsystem and prepare trip records in the Deployment Program. Redefinition of this file depends on changes in the BOS for each unit area. However, it may not be necessary to redefine it for each time period unless significant changes have occurred (e.g., another weapon detonates or severe environmental changes occur in many unit areas).

The above descriptions of the files used by LEMOS under DCPAMAIN are not detailed but should serve to create a more coherent view of the interconnections between LEMOS modules. A more detailed but less comprehensive view can be obtained by reviewing the record format descriptions in Appendix D.

Future work should attempt to further reduce the amount of data communicated between programs as a means for minimizing core memory requirements (under each overlay branch) and system running time. Each record field in all files should be reviewed for its contribution to the overall evaluation. This review cannot be undertaken until ADS and LEMOS are effectively integrated under DCPAMAIN.

IV. DISCUSSION AND CONCLUSIONS

The main accomplishments during the contract period were the development of the executive control (DCPAMAIN) for LEMOS (and for TELOS as well) and improved management of interconnecting files. The overlay structure approach in DCPAMAIN (perhaps better called TELOSMAIN) appears after study to be compatible with the UNIVAC 1100/10 at DCPACC. Therefore, all COBOL and FORTRAN programs at TUCC (including DCPAMAIN) should be converted to operate on the UNIVAC 1100/10 at DCPACC without further major modification.

Scenario definition and output requirements (both printed and CRT Displays) require additional study to ensure that TELOS will accomplish its research objectives.

After conversion and scenario review, DCPAMAIN should be modified to provide improved scenario controls including interactive update of the reference files, cyclical period controls between manual interventions with variable times per period, matrix modification of program control fields used in each cycle, and variable selection of programs on successive cycles. Other modifications will undoubtedly evolve as a result of the scenario study and need to be included in the system as the opportunity arises.

Concurrent with conversion of LEMOS programs to the UNIVAC system, the ADS programs should be modified to assess damage to special CD resources, including damage to highway bridges for the Transportation Subsystem. Since the countermeasures model relies heavily upon the transportation network, the Links File should be processed by ADS as well as the NETWORK program in the Transportation Subsystem.

When LEMOS is converted to operate on the equipment UNIVAC, GENUA, LOCATE, and ADS should be brought into the overlay structure so that the TELOS system will be essentially complete. Once the overall structure is

prepared, runs can be executed to validate the accuracy of each program. In order to facilitate this validation process, an accounting program should be written and appended to DCPAMAIN. This program would select certain sets of input fields for comparison with corresponding sets of output fields. Comparisons of this type will aid in detecting program errors, especially roundoff errors which would be difficult or time consuming to find otherwise. When all significant errors have been purged from the system, comprehensive scenario tests must be planned to establish the capabilties of the TELOS system and determine the effectiveness of the system in performing the various roles it may play either for research or for plans and operations.

V. RECOMMENDATIONS

RTI recommends that the LEMOS system be converted from the IBM 370/165 at TUCC to the UNIVAC 1100/10 at DCPACC. After conversion, the following developmental tasks should be undertaken.

- Determine scenario input and report/display output requirements.
- Integrate GENUA, LOCATE, ADS, and LEMOS under the same executive control using overlay or virtual memory procedures.
- Enable ADS to assess special CD resources and network link damage.
- Coordinate processing between ADS and LEMOS/operations model to prevent over or under estimation of injuries and deaths.
- Develop an accounting monitor to debug the TELOS system and perform extensive testing to evaluate system capabilities.

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APPENDIX A

DCPAMAIN PROGRAM LISTING

```
00001    000010 IDENTIFICATION DIVISION.
00002    000020 PROGRAM-ID. 'PGM1'.
00003    000030 ENVIRONMENT DIVISION.
00004    000040 INPUT-OUTPUT SECTION.
00005    000050 FILE-CONTROL.
00006               SELECT CARD-FILE ASSIGN TO UT-S-SYSIN.
00007               SELECT PRINT-FILE ASSIGN TO UT-S-SYSPRINT.
00008    000100 DATA DIVISION.
00009    000110 FILE SECTION.
00010    000120 FD  PRINT-FILE  RECORDING MODE IS F  LABEL RECORDS ARE OMITTED
00011    000140     RECORD CONTAINS 133 CHARACTERS  DATA RECORD IS PRINT-RECORD.
00012    000150 01  PRINT-RECORD.
00013    000160     02  CC                  PICTURE X.
00014    000170     02 PRINT-AREA     PICTURE X(132).
00015    000210 FD  CARD-FILE  RECORDING MODE IS F  LABEL RECORDS ARE OMITTED
00016    000220     RECORD CONTAINS 80 CHARACTERS BLOCK CONTAINS 0 RECORDS
00017    000230     DATA RECORD IS CARD-RECORD.
00018           01  CARD-RECORD.
00019               02 FILLER PIC X(80).
00020    000290 WORKING-STORAGE SECTION.
00021    000300 77  IN-REC PICTURE 9(6) COMPUTATIONAL-3 VALUE 0.
00022    000310 77  OUT-REC PICTURE 9(6) COMPUTATIONAL-3 VALUE 0.
00023           77  ASW    PIC S9(4) COMP SYNC.
00024           77  BSW    PIC S9(4) COMP SYNC.
00025           77  CSW    PIC S9(4) COMP SYNC.
00026           77  DSW    PIC S9(4) COMP SYNC.
00027           77  ESW    PIC S9(4) COMP SYNC.
00028           01  CONTROL-CARD.
00029               02 C-SNO PIC 9.
00030               02 FILLER PIC X(7).
00031               02 RUN-SW PIC X.
00032               02 TESTSW PIC X.
00033               02 A-SW   PIC 9.
00034               02 B-SW   PIC 9.
00035               02 C-SW   PIC 9.
00036               02 D-SW   PIC 9.
00037               02 E-SW   PIC 9.
00038           01  SORT-CONTROL.
00039               02 SORT-NO PIC 9.
00040           01  DATE-CARD COPY 'DATECARD'.
00041 C         01  DATE-CARD.
00042 C             02 DATE-RUN PIC X(8).
00043 C             02 RUN-SWITCH PIC X.
00044 C             02 IST-SWITCH PIC X.
00045 C             02 PRNT-SWITCH PIC X.
00046 C             02 POLICY-1 PIC 9.
00047 C             02 TYME PIC 999V9.
00048 C             02 PERIOD.
00049 C               03 PERIOD3 PIC 999V9.
00050 C               03 PERIOD1 PIC 99.
00051 C             02 TIME-FLAG PIC X.
00052 C             02 BUS-LEVEL1 PIC 999.
```

```
00053 C              02 BUS-LEVEL2 PIC 999.
00054 C              02 BUS-LEVEL3 PIC V99.
00055 C              02 BUS-LEVEL4 PIC V99.
00056 C              02 DEBRIS-LEVEL PIC 9V9 OCCURS 5 TIMES.
00057 C              02 POLICY-2 PIC 9.
00058 C              02 ZONE-NUMBER PIC 999.
00059 C              02 FILLER PIC X(25).
00060 C              02 PGM-SEQ PIC 99.
00061 C              02 NO-DATA-CARDS PIC 999.
00062 C              02 BYPASS-CONTROL PIC 9.
00063 C              02 COMM-CODE PIC 9.
00064 C              02 POSTURE-CODE PIC 99.
00065 C              02 CARD-CODE PIC 9.
00066 C //
00067    000600 PROCEDURE DIVISION.
00068    000610 START-PGM.
00069               DISPLAY 'START-EXEC-RESMAIN'.
00070    000620     OPEN INPUT CARD-FILE.
00071               DISPLAY 'OPENED CARD-FILE'.
00072          REPEAT-CONTROL.
00073               READ CARD-FILE INTO CONTROL-CARD AT END GO TO STOP-RUN.
00074               DISPLAY 'CONTROL-CARD ' CONTROL-CARD.
00075               IF RUN-SW = 'X'  GO TO STOP-RUN.
00076               IF RUN-SW = 'M'
00077                 PERFORM SORT-MASTER THRU SORT-MASTER-END.
00078               IF RUN-SW = 'P'
00079                 PERFORM SORT-PROB THRU SORT-PROB-END
00080               GO TO REPEAT-CONTROL.
00081               IF RUN-SW = 'R'
00082                 PERFORM SORT-RESC THRU SORT-RESC-END
00083               GO TO REPEAT-CONTROL.
00084               IF RUN-SW = '1'
00085                 PERFORM READ-DATE-CARD
00086                 PERFORM RUN-1 THRU RUN-1-END.
00087               IF RUN-SW = '2'
00088                 PERFORM READ-DATE-CARD
00089                 CALL 'NGM2' USING DATE-CARD
00090                 GO TO REPEAT-CONTROL.
00091               IF A-SW NOT NUMERIC  MOVE 0 TO A-SW.
00092               IF B-SW NOT NUMERIC  MOVE 0 TO B-SW.
00093               IF C-SW NOT NUMERIC  MOVE 0 TO C-SW.
00094               IF D-SW NOT NUMERIC  MOVE 0 TO D-SW.
00095               IF E-SW NOT NUMERIC  MOVE 0 TO E-SW.
00096               IF RUN-SW = '3'
00097                 MOVE A-SW TO ASW
00098                 CALL 'NGM3A' USING ASW
00099                 DISPLAY '* * * * * END-EXEC-OF-PGM=NETWORK * * * * * '
00100                 MOVE B-SW TO BSW
00101                 CALL 'NGM3B'  USING BSW
00102                 DISPLAY '* * * * * END-EXEC-OF-PGM=ALLNET  * * * * * '
00103                 MOVE C-SW TO CSW
00104                 CALL 'NGM3C'  USING CSW
00105                 DISPLAY '* * * * * END-EXEC-OF-PGM=DAMAGE  * * * * * '
00106                 MOVE D-SW TO DSW
00107                 CALL 'NGM3D'  USING DSW
```

```
00108                 DISPLAY '* * * * * END-EXEC-OF-PGM=FLOYD   * * * * * *'
00109                 MOVE E-SW TO ESW
00110                 CALL 'NGM3E'  USING ESW
00111                 DISPLAY '* * * * * END-EXEC-OF-PGM=TVLREC  * * * * * *'
00112                 GO TO REPEAT-CONTROL.
00113               IF RUN-SW = 'A'
00114                 MOVE A-SW TO ASW
00115                 CALL 'NGM3A' USING ASW
00116                 DISPLAY '* * * * * FINISH-EXEC-NETWORK * * * * * *'
00117                 GO TO REPEAT-CONTROL.
00118               IF RUN-SW = 'B'
00119                 MOVE B-SW TO BSW
00120                 CALL 'NGM3B'  USING BSW
00121                 DISPLAY '* * * * * FINISH-EXEC-ALLNET  * * * * * *'
00122                 GO TO REPEAT-CONTROL.
00123               IF RUN-SW = 'C'
00124                 MOVE C-SW TO CSW
00125                 CALL 'NGM3C'  USING CSW
00126                 DISPLAY '* * * * * FINISH-EXEC-DAMAGE  * * * * * *'
00127                 GO TO REPEAT-CONTROL.
00128               IF RUN-SW = 'D'
00129                 MOVE D-SW TO DSW
00130                 CALL 'NGM3D'  USING DSW
00131                 DISPLAY '* * * * * FINISH-EXEC-FLOYD   * * * * * *'
00132                 GO TO REPEAT-CONTROL.
00133               IF RUN-SW = 'E'
00134                 MOVE E-SW TO ESW
00135                 CALL 'NGM3E'  USING ESW
00136                 DISPLAY '* * * * * FINISH-EXEC-TVLREC  * * * * * *'
00137                 GO TO REPEAT-CONTROL.
00138               IF RUN-SW = '4'
00139                 PERFORM READ-DATE-CARD
00140                 MOVE 1 TO SORT-NO CALL 'DCPASORT' USING SORT-CONTROL
00141                 CALL 'NGM4' USING DATE-CARD.
00142               IF RUN-SW = '5'
00143                 PERFORM READ-DATE-CARD
00144                 MOVE 2 TO SORT-NO CALL 'DCPASORT' USING SORT-CONTROL
00145                 CALL 'NGM5' USING DATE-CARD
00146                 MOVE '2' TO RUN-SWITCH
00147                 MOVE 3 TO SORT-NO CALL 'DCPASORT' USING SORT-CONTROL
00148                 CALL 'NGM5' USING DATE-CARD
00149                 GO TO REPEAT-CONTROL.
00150               IF RUN-SW = '6'
00151                 PERFORM READ-DATE-CARD
00152                 MOVE 4 TO SORT-NO CALL 'DCPASORT' USING SORT-CONTROL
00153               CALL 'NGM6' USING DATE-CARD.
00154               IF RUN-SW = '7'
00155                 PERFORM READ-DATE-CARD
00156                 CALL 'NGM7' USING DATE-CARD
00157                 GO TO REPEAT-CONTROL.
00158               IF RUN-SW = '9'
00159                 PERFORM READ-DATE-CARD
00160                 PERFORM RUN-9 THRU RUN-9-END.
00161               IF RUN-SW = 'L'
00162                 PERFORM READ-DATE-CARD
```

```
_00163                  PERFORM LOOP THRU LOOP-END.
 00164                  GO TO REPEAT-CONTROL.
 00165          LOOP.
_00166                  DISPLAY 'LOOP NOT ESTABLISHED'.
 00167          LOOP-END. EXIT.
 00168          RUN-1.
_00169                  DISPLAY 'CALL-NGM1'.
 00170                  CALL 'NGM1' USING DATE-CARD.
 00171                  DISPLAY 'GOT BACK FROM NGM1'.
_00172          RUN-1-END. EXIT.
 00173          RUN-9.
 00174                  DISPLAY 'CALL-NGM9'.
_00175                  CALL 'NGM9' USING DATE-CARD.
 00176                  DISPLAY 'GOT BACK FROM NGM9'.
 00177          RUN-9-END. EXIT.
_00178          READ-DATE-CARD.
 00179                  READ CARD-FILE AT END GO TO EOJ.
 00180                  MOVE CARD-RECORD TO DATE-CARD.
_00181                  DISPLAY 'DATE-CARD' DATE-CARD.
 00182  000750  EOJ.
 00183          STOP-RUN.
_00184                  DISPLAY 'DCPA-RESMAIN-NORMAL-END'.
 00185  000800          CLOSE CARD-FILE.
 00186                  STOP RUN.
_00187          SORT-MASTER.
 00188                  MOVE 5 TO SORT-NO.
 00189                  DISPLAY 'CALLING DCPASORT'.
_00190                  CALL 'DCPASORT' USING SORT-CONTROL.
 00191                  DISPLAY 'GOT BACK FROM DCPASORT'.
 00192          SORT-MASTER-END. EXIT.
_00193          SORT-PROB.
 00194                  MOVE 6 TO SORT-NO.
 00195                  CALL 'DCPASORT' USING SORT-CONTROL.
_00196          SORT-PROB-END. EXIT.
 00197          SORT-RESC.
 00198                  MOVE 7 TO SORT-NO.
_00199                  CALL 'DCPASORT' USING SORT-CONTROL.
 00200          SORT-RESC-END. EXIT.
```

APPENDIX B

DCPASORT PROGRAM LISTING

```
00001   000010 IDENTIFICATION DIVISION.
00002   000020 PROGRAM-ID. 'DCPASORT'.
00003   000030 ENVIRONMENT DIVISION.
00004   000040 INPUT-OUTPUT SECTION.
00005   000050 FILE-CONTROL.
00006              SELECT CARD-FILE ASSIGN TO UT-S-SYSIN.
00007              SELECT OLD-MASTER ASSIGN TO UT-S-FILE5.
00008              SELECT NEW-MASTER ASSIGN TO UT-S-FILE2.
00009              SELECT FILE-3 ASSIGN TO UT-S-FILE3.
00010              SELECT FILE-4 ASSIGN TO UT-S-FILE4.
00011              SELECT FILE20 ASSIGN TO UT-S-FILE20.
00012              SELECT FILE21 ASSIGN TO UT-S-FILE21.
00013              SELECT FILE26 ASSIGN TO UT-S-FILE26.
00014              SELECT SORT-MAST ASSIGN TO UT-S-SORTWK01
00015                                         UT-S-SORTWK02
00016                                         UT-S-SORTWK03.
00017              SELECT SORT-ASGN ASSIGN TO UT-S-SORTWK01
00018                                         UT-S-SORTWK02
00019                                         UT-S-SORTWK03.
00020              SELECT SORT-PROB ASSIGN TO UT-S-SORTWK01
00021                                         UT-S-SORTWK02
00022                                         UT-S-SORTWK03.
00023              SELECT SORT-RESC ASSIGN TO UT-S-SORTWK01
00024                                         UT-S-SORTWK02
00025                                         UT-S-SORTWK03.
00026   000100 DATA DIVISION.
00027   000110 FILE SECTION.
00028   000210 FD  CARD-FILE  RECORDING MODE IS F  LABEL RECORDS ARE OMITTED
00029   000220     RECORD CONTAINS 80 CHARACTERS BLOCK CONTAINS 0 RECORDS
00030   000230     DATA RECORD IS CARD-RECORD.
00031          01  CARD-RECORD.
00032              02 FILLER PIC X(80).
00033          SD  SORT-ASGN DATA RECORD ASGN-RECORD.
00034          01  ASGN-RECORD.
00035              02 FILLER PIC X(16).
00036              02 OPERATION-NO.
00037                03 FILLER PIC X(08).
00038                03 OP-PRTY PIC 99.
00039                03 FILLER PIC X(05).
00040              02 FILLER PIC X(01).
00041              02 TEAM PIC 99.
00042              02 FILLER PIC X(02).
00043              02 EUC PIC 99.
00044              02 FILLER PIC X(02).
00045              02 UG-PRTY PIC 99.
00046              02 FILLER PIC X(110).
00047              02 INITIAL-PRIORITY PIC 99V9.
00048              02 FILLER PIC X(85).
00049          SD  SORT-MAST DATA RECORD MAST-RECORD.
00050          01  MAST-RECORD.
00051              02 MAST-CODE PICTURE 9.
00052              02 MAST-SUB-TYPE PICTURE 9.
```

```
00053                   02 FILLER PICTURE X(09).
00054                   02 MAST-UA-CODE PICTURE X(6).
00055                   02 MAST-LUC-CODE PIC X(08).
00056                   02 FILLER PICTURE X(63).
00057             FD    OLD-MASTER RECORDING MODE F LABEL RECORDS STANDARD
00058                   RECORD CONTAINS 88 CHARACTERS BLOCK CONTAINS 40 RECORDS
00059                   DATA RECORD OLD-MASTER-RECORD.
00060             01    OLD-MASTER-RECORD.
00061                   02 FILLER PIC X(88).
00062             FD    NEW-MASTER RECORDING MODE F LABEL RECORDS STANDARD
00063                   RECORD CONTAINS 88 CHARACTERS BLOCK CONTAINS 40 RECORDS
00064                   DATA RECORD NEW-MASTER-RECORD.
00065             01    NEW-MASTER-RECORD.
00066                   02 FILLER PIC X(88).
00067             SD    SORT-PROB DATA RECORD PROB-RECORD.
00068             01    PROB-RECORD.
00069                   02 PROB-AREA PIC X(6).
00070                   02 PROB-LINK PIC X(2).
00071                   02 PROB-LUC  PIC X(2).
00072                   02 PROB-CLASS PIC X.
00073                   02 FILLER PIC X(59).
00074             SD    SORT-RESC DATA RECORD RESC-RECORD.
00075             01    RESC-RECORD.
00076                   02 RESC-AREA PIC X(6).
00077                   02 RESC-LINK PIC X(2).
00078                   02 RESC-LUC  PIC X(2).
00079                   02 FILLER PIC X(119).
00080             FD    FILE-3 RECORDING MODE F LABEL RECORDS STANDARD
00081                   RECORD CONTAINS 070 CHARACTERS BLOCK CONTAINS 40 RECORDS
00082                   DATA RECORD RECORD-3.
00083             01    RECORD-3 PIC X(70).
00084             FD    FILE-4 RECORDING MODE F LABEL RECORDS STANDARD
00085                   RECORD CONTAINS 129 CHARACTERS BLOCK CONTAINS 20 RECORDS
00086                   DATA RECORD RECORD-4.
00087             01    RECORD-4 PIC X(129).
00088             FD    FILE20   RECORDING MODE F LABEL RECORDS STANDARD
00089                   RECORD CONTAINS 240 CHARACTERS BLOCK CONTAINS 20 RECORDS
00090                   DATA RECORD REC20.
00091             01    REC20 PIC X(240).
00092             FD    FILE21   RECORDING MODE F LABEL RECORDS STANDARD
00093                   RECORD CONTAINS 240 CHARACTERS BLOCK CONTAINS 20 RECORDS
00094                   DATA RECORD REC21.
00095             01    REC21 PIC X(240).
00096             FD    FILE26   RECORDING MODE F LABEL RECORDS STANDARD
00097                   RECORD CONTAINS 240 CHARACTERS BLOCK CONTAINS 20 RECORDS
00098                   DATA RECORD REC26.
00099             01    REC26 PIC X(240).
00100    000290 WORKING-STORAGE SECTION.
00101           LINKAGE SECTION.
00102             01    SORT-CONTROL.
00103                   02 SORT-NO PIC 9.
00104                   02 FILLER PIC X(79).
00105    000600 PROCEDURE DIVISION USING SORT-CONTROL.
00106    000610 START-PGM.
00107                   MOVE 100000 TO SORT-CORE-SIZE.
```

```
00108            IF SORT-NO NOT NUMERIC
00109              DISPLAY 'SORT-NO-NOT-NUMERIC, ABORTED'
00110              GO TO RETURN-STEP.
00111            GO TO SR1 SR2 SR3 SR4 SR5 SR6 SR7 SR8 SR9
00112              DEPENDING ON SORT-NO.
00113        SR1.
00114            SORT SORT-ASGN ON
00115              ASCENDING KEY TEAM
00116              ASCENDING KEY INITIAL-PRIORITY
00117              USING FILE20
00118              GIVING FILE20.
00119              GO TO RETURN-STEP.
00120        SR2.
00121            SORT SORT-ASGN ON
00122              ASCENDING KEY OPERATION-NO
00123              USING FILE21
00124              GIVING FILE21.
00125              GO TO RETURN-STEP.
00126        SR3.
00127            SORT SORT-ASGN ON
00128              ASCENDING KEY OP-PRTY
00129              USING FILE20
00130              GIVING FILE20.
00131              GO TO RETURN-STEP.
00132        SR4.
00133            SORT SORT-ASGN ON
00134              ASCENDING KEY EOC
00135              ASCENDING KEY OP-PRTY
00136              USING FILE26
00137              GIVING FILE26.
00138              GO TO RETURN-STEP.
00139        SR5.
00140            SORT SORT-MAST ON
00141              ASCENDING KEY MAST-UA-CODE
00142              ASCENDING KEY MAST-CODE
00143              ASCENDING KEY MAST-SUB-TYPE
00144              ASCENDING KEY MAST-LOC-CODE
00145              USING OLD-MASTER
00146              GIVING NEW-MASTER.
00147              GO TO RETURN-STEP.
00148        SR6.
00149            SORT SORT-PROB ON
00150              ASCENDING KEY PROB-AREA
00151              ASCENDING KEY PROB-LOC
00152              ASCENDING KEY PROB-CLASS
00153              USING FILE-3
00154              GIVING FILE-3.
00155              GO TO RETURN-STEP.
00156        SR7.
00157            SORT SORT-RESC ON
00158              ASCENDING KEY RESC-AREA
00159              ASCENDING KEY RESC-LOC
00160              USING FILE-4
00161              GIVING FILE-4.
00162              GO TO RETURN-STEP.
```

```
00163           SR8.
00164           SR9.
00165                 GO TO RETURN-STEP.
00166           RETURN-STEP.
00167           EOJ.
00168               GOBACK.
```

APPENDIX C

OCPAMAIN RUN CONTROLS

DCPA MAIN RUN CONTROLS

- Hours from beginning of scenario.
- Duration of current period, in hours.
- Sequence number of current period.
- Flag to indicate whether or not there was a previous period.
- Code for minimum PF level for shelter spaces to be used.
- Code for maximum floor height (above ground) for shelter spaces to be used.
- Low radiation level (RADS) for defining the basic operating situation (BOS).
- High radiation level (RADS) for defining BOS.
- Low fire level (fraction of area aflame) for defining BOS.
- High fire level (fraction of area aflame) for defing BOS.
- Codes for defining five depths of debris.
- Zone number of area being studied.
- Level of PF provided by being in automobile.
- Length of work shift, in hours.
- Fraction of casualties who are ambulatory, for fifteen (15) injury categories.
- Maximum number of teams to be assigned to one problem.
- Identification of sanctuary area for this zone.
- Priority ranking of operations.
- Code to indicate whether or not CD can expropriate resources from residences.
- Code to indicate whether or not population is warned.
- Time of warning, if warned. (Note: not presently included)
- Weights used to compute measure of effectiveness.

APPENDIX D

FILE DESCRIPTIONS

APPENDIX D

FILE DESCRIPTIONS

This appendix contains updated field descriptions for records contained in the following files:

A. Reference (REFERENCE)

   1. Team Table
   2. Alternative Table
   3. Work Table
   4. Function Table
   5. Operations Table
   6. Land-Use Class Density Table

B. Master Status (MSF)

   1. Area-Record Format
   2. Struc-Data Format
   3. Shelter-Data Format
   4. Personnel-Status Record
   5. Special-Resources Format

C. Problem (PROB)
   1. Prob-Type-1 Record
   2. Prob-Type-2 Record
   3. Prob-Type-3 Record
   4. Prob-Type-4 Record

D. Resource (RESOURCE)

E. Organization (ORGN)

F. Service (SERVICE)

G. Operations (OPS)

H. Assignment (ASGN)

I. Trip (TRIP)

J. History (HISTORY)

K. Performance

L. Plot (PLOT)

M. Benefits (BENEFITS)

N. Links (LINKS)

O. Travel Reference (TVLREF)

A. Reference File

1. Team Table

The format for the team table is shown in Table A-I, T-TABLE FORMAT.

Table A-I

T-TABLE FORMAT

COBOL Variable	COBOL Format	Card Columns	Remarks
TEAM-TABLE			Occurs 47 times.
TEAM-NO-8	99	1-2	
NO-PERS	99	3-4	
FAC-REQMT-CODE	9	5	
PER-SET-NO		6-35	Occurs 6 times.
PERS-NO-8	999	(6-8)	First Set.
NO-PERS-8	99	(9-10)	
		.	.
		.	.
		.	.
		(31-33)	Sixth Set.
		(34-35)	
EQPT-SET-NO		36-75	Occurs 8 times.
EQUIP-NO-8	99	(36-37)	First Set.
NO-ITEMS	999	(38-40)	
		.	.
		.	.
		.	.
		(71-72)	Eighth Set.
		(73-75)	
FILLER	X(5)	76-80	Code 1 in Column 8 indicating first card.
SUPPLY-SET		1-60	Occurs 6 times.
SUPPLY-NO-8	99	(1-2)	
SUPPLY-CAP	9999	(3-6)	First Set.
SUP-RATE	9999	(7-10)	
		.	.
		.	.
		.	.
		(51-52)	Sixth Set.
		(53-56)	
		(57-60)	
FILLER	XX	61-62	
SERVICE	99	63-64	Code for respective service.
TEAM-NAME	X(14)	65-78	
MOB-CODE	X	79	
FILLER	X	80	

Team Table continued.

1. TEAM-NO-8. The identification number of each team.
2. NO-PERS. The total number of people required in order for the team to operate.
3. FAC-REQMT-CODE. An indicator of the requirement of a facility for team operation.
   a. 1 indicates a facility is required.
   b. 0 indicates a facility is not required.
4. PER-SET-NO
   a. PERS-NO-8. The identification number of the types of personnel required for team operation--up to six different types of personnel allowed.
   b. NO-PERS-8. The quantity of people required for each personnel type.
5. EQPT-SET-NO
   a. EQUIP-NO-8. The identification number of the types of equipment required for team operation--up to 8 different types allowed.
   b. NO-ITEMS. The quantity of equipment required for each equipment type.
6. SUPPLY-SET
   a. SUPPLY-NO-8. The identification number of the types of supplies required for team operation--up to 6 different types of supplies allowed.
   b. SUPPLY-CAP. The capacity of the supply item.
   c. SUP-RATE. The consumption rate for the respective supply item.
7. SERVICE. The service identification number to which the team belongs (there are ten service types):
   a. Headquarters
   b. Welfare
   c. Medical
   d. Fire

Team Table continued.

e. Police

f. Rescue

g. Engineering

h. Transportation

i. Communication

j. Stock Control

8. TEAM-NAME. The name of the respective team.

9. MOB-CODE. The code which indicates whether a vehicle is needed in order for the team to operate.

a. 1 indicates that a vehicle is needed.

b. 0 indicates that no vehicle is required.

2. Alternative Table

The format for the alternative table is given in Table A-II, TABLE-C FORMAT.

Table A-II

TABLE-C FORMAT

COBOL Variable	COBOL Format	Card Columns	Remarks
ALTN-TABLE*			Occurs 6 times.
PROB-CLASS			
PROB-CODE	X		
PROB-SER	99		
NO-PROB	99		
PROB-NO	XX		Occurs 9 times.
NO-ALTN	9		
OPN-PAIR			Occurs 7 times.
BASE	999		
COMP	999		
FILLER	X		Occurs 7 times.
FILLER	X(7)		

* Format for each of the four alternative problem types (i.e., Control-C, Damage-D, Increase Readiness-I, and Relief-R) are identical; therefore, only a general explanation is given.

1. PROB-CLASS
   a. PROB-CODE. The identification code for the problem type.
   b. PROB-SER. Sequence number in the alternative table.
2. NO-PROB. The problem set number.
3. PROB-NO. The number of each problem in the set.
4. NO-ALTN. The number of alternatives in the problem set.
5. OPN-PAIR. Operation number pair.
   a. BASE. Operation number to be performed at the current location.
   b. COMP. Operation number to be performed at the other location.

3. Work Table

The format for the work table which is associated with the functions is given in Table A-III, WORK-TABLE FORMAT. A brief description of each variable is given below.

Table A-III

WORK-TABLE FORMAT

COBOL Variable	COBOL Format	Remarks
WORK-TAB		Occurs 42 times.
WORK		
FILLER	X	
WK-NO	99	
PREP-RATE	999V999	
PROD-RATE	999V999	
WK-CAPACITY	9(6)	
FILLER	X(59)	

1. WK-NO. The function identification number.
2. PREP-RATE. The time spent in preparation per unit to be processed.
3. PROD-RATE. Hours per unit processed.
4. WK-CAPACITY. Maximum number of units that can be processed by a given team.

4. Function Table

The format for this table is given in Table A-IV, F-TABLE FORMAT.

Table A-IV

F-TABLE FORMAT

COBOL Variable	COBOL Format	Card Columns	Remarks
FUNCTION-TABLE			Occurs 42 times, one card for each function, plus 1 extra set (for storage space).
FUNCTION-NO	99	1-2	
FUNCTION-NAME	X(12)	3-14	
NO-ALTN	9	15	
ALTN-TEAM		16-42	Occurs 3 times.
TEAM-NO	99	(16-17)	First alternate team.
EFF-7	9V99	(18-20)	
TRAIN-HRS	999V9	(21-24)	
		(25-26)	Second alternate team.
		(27-29)	
		(30-33)	
		(34-35)	Third alternate team.
		(36-38)	
		(39-42)	
ALLOW	99	43-62	Occurs 10 times.
		(43-44)	First
		.	.
		.	.
		.	.
		(61-62)	Tenth

1. FUNCTION-NO. The identification number of the function.
2. FUNCTION-NAME. The name of the function.
3. NO-ALTN. The number of teams that can perform this function.
4. ALTN-TEAM
   a. TEAM-NO. Team identification number.
   b. EFF-7. The efficiency with which the team can perform the function.
   c. TRAIN-HRS. The average hours a team must spend in training.
5. ALLOW. Specified whether this function is allowed or disallowed under the conditions specified by the ten possible environmental conditions determined by the environment class.
   a. 0 indicates disallowed.
   b. 1 indicates allowed.

5. Operations Table

The format for the Operations Table is shown in Table A-V, TABLE-O FORMAT.

Table A-V

TABLE-O FORMAT

COBOL Variable	COBOL Format	Card Columns	Remarks
OPN-TABLE			Occurs 144 times--one card for each operation
OPN-NO			
OPN-NO-T	999	1-3	
NO-FUNC	99	4-5	
OP-FUNC-SET			
FUNC-NO	99	6-29	Occurs 12 times.
		(6-7)	
		(8-9)	
		.	
		.	
		.	
		(28-29)	
FILLER	X	30	
OPN-ALTN			
OPN-A	999	31-33	
OPN-B	999	34-36	
COMBINATION-TABLE			
NUM-COMB	9	37	
OPN-COMB		38-79	Occurs 7 times.
OPN-COMP	999	(38-40)	First
COMB-NO	999	(41-43)	
		.	
		.	
		(74-76)	Seventh
		(77-79)	
FILLER	X	80	

1. OPN-NO. The identification number of the operation.
2. NO-FUNC. The number of functions in operation.
3. OP-FUNC-SET. Function number for each function in operation.
4. OPN-ALTN. Operation pair equivalent of OPN-NO above.
   a. OPN-A. Initial part of operation.
   b. OPN-B. Complementary part of operation.
5. COMBINATION-TABLE
   a. NUM-COMB. The number of combinations for a given operation.
   b. OPN-COMB
      (1) OPN-COMP. The initial operation for the combination number.
      (2) COMB-NO. The identification number for the combination.

6. Land-Use Class Density Table

The format for the LUC Density Table is given in Table A-VI, TABLE-2 FORMAT.

Table A-VI

TABLE-2 FORMAT

COBOL Variables	COBOL Format	Card Columns	Remarks
TAB-2			Occurs 64 times, one card for each land-use class.
FILLER	X	1	
TYPE-STRUC	9999	2-5	
DENSITY-A	9999V99	6-11	
FILLER	X(69)	12-80	

1. TYPE-STRUC. Identification number for the types of land use

2. DENSITY-A. The average number of buildings (all structure types) per square mile for the particular land use.

B. Master Status File

This section contains a detailed description of the input data and its format in the Master Status File (MSF). This file is used by both TELOS and LEMOS and thus forms the main link between the systems.

1. AREA-RECORD Record

The format for the record is shown in Table B-I, AREA-RECORD FORMAT. One card is needed for each unit area.

Table B-I

AREA-RECORD FORMAT

COBOL Variable	COBOL Format	Card Columns	Remarks
CODE-1	9	1	Value is 1.
FILLER	X	2	
TIME-PERIOD	9999	3- 6	Sequence number of time period
FILLER	X(5)	7-11	
ZONE-PART	999	12-14	Zone number
AREA-PART	999	15-17	Area number
FILLER	XX	18-19	
T-INTERVAL	9(5)	20-24	In minutes
LAT	99V999	25-29	Latitude
LON	999V999	30-35	Longitude
TOTAL-AREA	9999V99	36-41	
LUC-PCT	X(20)	42-61	99 occurs 10 times
CUR-DOSE-RATE	9(5)	62-66	r/hr.
BLAST-RISK-CODE	9	67	
FALLOUT-RISK-CODE	9	68	
AREA-POP	9(6)	69-74	
SHELTER	9(6)	75-80	
GEN-STATUS-CODE	9	81	
FILLER	X(7)	82-88	

a. CODE-1. A "1".

b. TIME-PERIOD. The sequence number of the current time period.

c. ZONE-PART. The zone in which the unit area is located.

d. AREA-PART. The unit area sequence number.

e. T-INTERVAL. The length of the current time interval.

f. LAT. The latitude (weighted by area) of the centroid of the unit area, to 0.001 degree.

g. LON. The longitude (weighted by area) of the centroid of the unit area, to 0.001 degree.

AREA-RECORD Record, continued.

h. TOTAL-AREA. The area of the unit area, in square miles.

i. LUC-PCT. The percentages of area distribution (the actual assigned area, see Section V) of Land-Use Classes (LUC) R1 Vacant, R2, RM, Lakes and Water, Commercial (general), Commercial (major), Industrial, Agricultural, and the remaining LUC's, respectively.

j. CUR-DOSE-RATE. The dose rate for the current time period, in Roentgens/hour.

k. BLAST-RISK-CODE. A single digit code expressing the overall vulnerability of the unit area with respect to blast:

(0) Don't know
(1) No blast risk
(2) Low blast risk
(3) High blast risk.

l. FALLOUT-RISK-CODE. A single digit code expressing the overall vulnerability of the unit area with respect to fallout:

(0) Don't know
(1) No fallout risk
(2) Low fallout risk
(3) High fallout risk.

m. AREA-POP. The total population of the unit area.

n. SHELTER. The total number of shelter spaces in the unit area.

o. GEN-STATUS-CODE. A single digit code expressing the overall status of the unit area:

(1) Original state
(2) Unscathed (<1 psi and <4 cal/cm^2)
(3) Scathed (1-2 psi and <4 cal/cm^2)
(4) Stricken (2-20 psi or >4 cal/cm^2)
(5) Devastated (>20 psi and >4 cal/cm^2).

2. STRUC-DATA Record

The format for the record is shown in Table B-II, STRUC-DATA FORMAT. One card is needed for each building type (Cols. 20-22) in each land use class present in the unit area.

Table B-II

STRUC-DATA FORMAT

COBOL Variable	COBOL Format	Card Columns	Remarks
CODE-2	9	1	Value 2
FILLER	X	2	
TIME-PERIOD	9999	3- 6	Sequence number of time period
FILLER	X(5)	7-11	
ZONE-PART	999	12-14	Zone number
AREA-PART	999	15-17	Area number
LUC	99	18-19	See Table C-I, "LAND-USE-CODES"
STORIES-CODE	9	20	
BLAST-RESIST-CODE	9	21	
FIRE-RESIST-CODE	9	22	
DAMAGE-CODE	99	23-24	
GEN-DEBRIS	9	25	
ROUTE-DEBRIS	9	26	
NO-UNDAM	9(6)	27-32	
NO-STAGE1	9(6)	33-38	
NO-STAGE2	9(6)	39-44	
NO-STAGE3	9(6)	45-50	
NO-STAGE4	9(6)	51-56	
AREA-AFLAME	99	57-58	
FILLER	X(30)	59-88	

a. CODE-2. A "2".

b. TIME-PERIOD. The sequence number of the current time period.

c. ZONE-PART. The zone in which the unit area is located.

d. AREA-PART. The unit area sequence number.

e. LUC. The identification number for the land-use code

STRUC-DATA Record, continued.

f. STORIES-CODE. A code which gives the number of stories of the facility being described:

(0) Underground
(1) 1 - 2 stories
(2) 3 - 5 stories
(3) 6 - 10 stories
(4) 11 - 15 stories
(5) 16 - 20 stories
(6) 21 - 25 stories
(7) 26 - 30 stories
(8) 31 - 40 stories
(9) Over 40 stories

g. BLAST-RESIST-CODE. A code which gives the blast resistance of the facility:

(0) Special
(1) Light panel or framing
(2) Masonry bearing wall
(3) Column and beam, curtain walls
(4) Column and beam, in-fil walls
(5) Column and slab, curtain walls
(6) Column and slab, in-fil walls
(7) Column and plate, curtain walls
(8) Column and plate, in-fil walls
(9) Long-span construction

h. FIRE-RESIST-CODE. A code which gives the fire resistance of the facility:

(0) Special
(1) A wall A roof L combustible load
(2) A wall A roof M combustible load
(3) A wall A roof H combustibel load
(4) A wall B roof L combustible load
(5) A wall B roof M combustible load
(6) A wall B roof H combustible load
(7) B wall B roof L combustible load
(8) B wall B roof M combustible load
(9) B wall B roof H combustible load

Where A wall has minor susceptibility to fire spread
A roof has minor susceptibility to fire spread
B wall has major susceptibility to fire spread
B roof has major susceptibility to fire spread
L load is less than 20 lbs/ft^2
M load is 20 to 40 lbs/ft^2
H load is over 40 lbs/ft^2

STRUC-DATA Record, continued.

k. ROUTE-DEBRIS. A code which is used primarily for LUC 05 to describe the overall debris in streets. (See j. GEN-DEBRIS, above.)

l. NO-UNDAM. The number of structures of the given type undamaged or not burned out.

m. NO-STAGE1. The number of structures of the given type that are in stage 1 (ignited).

n. NO-STAGE2. The number of structures of the given type that are in stage 2 (growing intensity).

o. NO-STAGE3. The number of structures of the given type that are in stage 3 (past peak).

p. NO-STAGE4. The number of structures of the given type that are in stage 4 (burned out).

q. AREA-AFLAME. The percent of the area in the LUC that is aflame.

i. DAMAGE-CODE. A code which gives the damage suffered by the facility:

00	Undamaged
10	Light blast damage
11	Heavy blast damage
12	Light blast and light fire damage
20	Light fire damage
22	Heavy fire damage
91	Destroyed by blast only
92	Destroyed by fire only
93	Damaged by blast destroyed by fire
94	Destroyed by blast and fire multiple weapon

j. GEN-DEBRIS. A code which is used for all LUC's other than 05 to describe the overall debris in the land-use-class:

(0) No debris
(1) Scattered
(2) Light debris
(3) Medium debris
(4) Heavy debris
(5) Extra heavy debris

3. SHELTER-DATA Record

The format for the record is shown in Table B-III, SHELTER-DATA FORMAT.

Table B-III

SHELTER-DATA FORMAT

COBOL Variable	COBOL Format	Card Columns	Remarks
CODE-3	9	1	Value 3
SUBTYPE-CODE	9	2	Value 0 = spaces; value 1 = people
TIME-PERIOD	9999	3- 6	Sequence number of time period
FILLER	X(5)	7-11	
ZONE-PART	999	12-14	Zone number
AREA-PART	999	15-17	Area number
LUC	99	18-19	
STORIES-CODE	9	20	} Same as STRUC-DATA Record
BLAST-RESIST-CODE	9	21	
FIRE-RESIST-CODE	9	22	
TOTAL-SPACES	9(8)	23-30	(Or people if SUBTYPE-CODE = 1)
BELOW-PF-DIST	X(16)	31-46	V99 occurs 8 times
LOWER-PF-DIST	X(16)	47-62	V99 occurs 8 times
UPPER-PF-DIST	X(16)	63-78	V99 occurs 8 times
FILLER	X(10)	79-88	

a. CODE-3. A "3".

b. SUBTYPE-CODE. A value of "0" indicates shelter spaces, and a value of "1" indicates people in shelter spaces.

c. TIME-PERIOD. The sequence number of the current time period.

d. ZONE-PART. The zone in which the unit area is located.

e. AREA-PART. The unit area sequence number.

f. LUC.

g. STORIES-CODE. See STRUC-DATA Record.

h. BLAST-RESIST-CODE. See STRUC-DATA Record.

i. FIRE-RESIST-CODE. See STRUC-DATA Record.

j. TOTAL-SPACES. The total number of spaces or people in spaces in structures of the given type.

SHELTER-DATA Record, continued.

k. BELOW-PF-DIST. The distribution of shelter spaces (or people in spaces) by PF category for below-ground spaces:

(1)	NFSS B	PF: <5
(2)	NFSS A	PF: 5-9
(3)	NFSS 0	PF: 10-19
(4)	NFSS 1	PF: 20-39
(5)	NFSS 2	PF: 40-69
(6)	NFSS 3	PF: 70-99
(7)	NFSS 4	PF: 100-149
(8)	NFSS 5-6	PF: 150-499
(9)	NFSS 7-8	PF: 500-up

l. LOWER-PF-DIST. The distribution of shelter spaces (or people in spaces) by PF category for lower story spaces (see above for codes).

m. UPPER-PF-DIST. The distribution of shelter spaces (or people in spaces) by PF category for upper story spaces (see above for codes).

4. PERSONNEL-STATUS Record

The format for the record is shown in Table B-IV, PERSONNEL-STATUS FORMAT.

Table B-IV

PERSONNEL-STATUS RECORD

COBOL Variable	COBOL Format	Card Columns	Remarks
CODE-4	9	1	Value 4
FILLER	X	2	
TIME-PERIOD	9999	3- 6	Sequence number of time period
FILLER	X(5)	7-11	
ZONE-PART	999	12-14	Zone number
AREA-PART	999	15-17	Area number
LUC	99	18-19	
STORIES-CODE	9	20	Same as STRUC-DATA Record
BLAST-RESIST-CODE	9	21	
FIRE-RESIST-CODE	9	22	
INJURY-CODE	99	23-24	
TRAPPED	9(6)	25-30	
UNINJ	9(6)	31-36	Those who originally had INJURY-CODE
INJ-PHASES:	X(39)	37-75	
MEAN-TIME	99V9	37-49	X(13) occurs 3 times
MIN-TIME	99	50-62	
MAX-TIME	99	63-75	
CASUALTIES	9(6)		
MEAN-DOSE	999V9	76-79	
MIN-DOSE	999	80-82	
MAX-DOSE	999	83-85	
FILLER	XXX	86-88	

a. CODE-4. A "4".

b. TIME-PERIOD. The sequence number of the current time period.

c. ZONE-PART. The zone in which the unit area is located.

d. AREA-PART. The unit area sequence number.

e. LUC.

f. STORIES-CODE. See STRUC-DATA Record.

g. BLAST-RESIST-CODE. See STRUC-DATA Record.

h. FIRE-RESIST-CODE. See STRUC-DATA Record.

i. INJURY-CODE. A code which gives the type of injury:

00	Uninjured
10	Blast
11	Multiple blast
20	Thermal
21	Multiple thermal
22	Blast and thermal
30	Radiation

PERSONNEL-STATUS Record, continued.

31	Multiple radiation
32	Blast and radiation
33	Thermal and radiation
40	Fire injuries
41	Multiple fire
42	Blast and fire
43	Thermal and fire
44	Radiation and fire
50	Fallout injuries
90	Fatalities
91	Blast killed immediately
92	Thermal or fire killed immediately
93	Radiation killed immediately
94	Combination (91,92,93) killed immediately
95	Died from blast injury
96	Died from thermal or fire injuries
97	Died from radiation injury
98	Died from combination of effects
99	All causes

j. TRAPPED. The number of people (including CD) with the given injury code and building type who are trapped.

k. UNINJ. The number of people (including CD) who either originally had the given injury code and are now healthy or were never injured.

l. INJ-PHASES. The injured people (including CD) are subdivided into three groups (phases) depending upon their time of injury. The following variables occur in three sets, corresponding to the three phases:

(1) MEAN-TIME. The mean time at which people in the given phase were injured.

(2) MIN-TIME. The earliest time at which people in the given phase were injured.

(3) MAX-TIME. The latest time at which people in the given phase were injured.

(4) CASUALTIES. The number of people (including CD) in the given phase with the given injury code.

m. MEAN-DOSE. The average accumulated dose (in rads) for all people included on the record as of the beginning of the current period.

n. MIN-DOSE. The minimum dose (in rads) accumulated by the beginning of the current period.

o. MAX-DOSE. The maximum dose (in rads) accumulated by the beginning of the current period.

5. SPECIAL-RESOURCES Record

The format for the record is shown in Table B-V, SPECIAL-RESOURCES FORMAT. All CD resources are described using this format.

Table B-V

SPECIAL-RESOURCES FORMAT

COBOL Variable	COBOL Format	Card Columns	Remarks
CODE-5	9	1	Value 5
SUBTYPE-CODE	9	2	Value 0 = non-transient; value 1 = transient
TIME-PERIOD	9999	3- 6	Sequence number of time period
FILLER	X(5)	7-11	
ZONE-PART	999	12-14	Zone number
AREA-PART	999	15-17	Area number
LUC	99	18-19	
FILLER	XXX	20-22	
ASSET-CODE	9	23	
ASSET-NUMBER	99	24-25	
POSTURE	99	26-27	
SUPV-COMP	9	28	Value 1 = Non-CD; value 2 = CD
SUPV-ORGN	9(8)	29-36	Not used
CONDITION	9	37	
EFF-FACTOR	9V99	38-40	
QUANTITY	9(6)	41-46	
TRAILERS:	X(30)	47-88	Only for Asset Codes 1, 2, or 3
(Facilities)			
FAC-DAM-CODE	99	47-48	
FAC-STAT-PCT	X(25)	49-73	9V9999 occurs 5 times
FAC-DEBRIS	9	74	
FILLER	X(14)	75-88	
(Shelter Spaces)			
SHEL-LVL-CODE	9	47	
PF-DIST	X(16)	48-65	99 occurs 9 times
FILLER	X(23)	66-88	
(Personnel)			
INJ-CODE	99	47-48	
TRAPPED-PCT	9V99	49-51	
INJ-PHASES:	X(30)	52-81	
MEAN-TIME	99V9		X(10) occurs 3 times (once for each phase)
MIN-TIME	99		
MAX-TIME	99		
INJ-PERC	9V99		
MEAN-DOSE	99V9	82-84	In tens of rads
MIN-DOSE	99	85-86	
MAX-DOSE	99	86-87	

SPECIAL-RESOURCES Record, conuinued.

a. CODE-5. A "5".

b. SUBTYPE-CODE. A value of "0" indicates non-transient resources; a value of "1" indicates transient resources.

c. TIME-PERIOD. The sequence number of the current time period.

d. ZONE-PART. The zone in which the unit area is located.

e. AREA-PART. The unit area sequence number.

f. LUC.

g. ASSET-CODE. A single digit describing the asset being described on the record:

(1) Facilities
(2) Shelter spaces
(3) People
(4) Equipment
(5) Material
(6) Supplies
(7) Teams

h. ASSET-NUMBER. A double-digit code further defining the asset listed on the record.

(1) People
(2) Teams
(3) Spaces
(4) Building
(5) Equipment
(6) Rations
(7) Water
(8) Fuel
(9) Miscellaneous supplies
(10) Material
(11) Capacity units (e.g., beds, hospitals)

i. POSTURE. A double-digit code expressing the posture of the population:

10 Inside basement prone
11 Inside basement standing
12 Inside lower floors prone
13 Inside lower floors standing
14 Inside upper floors prone
15 Inside upper floors standing
20 Outside shielded prone
21 Outside shielded standing
22 Outside unshielded prone
23 Outside unshielded standing
31 Trapped in basements

j. SUPV-COMP. A single-digit code expressing whither or not the resources listed are non-CD (value = 1) or CD (value = CD).

SPECIAL-RESOURCES Record, continued.

k. SUPV-ORGN. Not used.

l. CONDITION. A single-digit code expressing the condition of the resources, used in conjunction with EFF-FACTOR (see below):

(0) Undamaged
(1) Damaged (repairable)
(2) Destroyed (salvageable)
(3) Destroyed (not salvageable)

m. EFF-FACTOR. A factor which expresses what percent of the resource can be repaired (if CONDITION = 1) or can be converted to supplies (if CONDITION = 2).

n. QUANTITY. The amount of the resource listed.

TRAILERS: Records which list facilities, shelter spaces, or personnel have additional data, described below.

o. FACILITIES

(1) FAC-DAM-CODE. A double-digit code expressing the damage to the facilities listed (see B-H.2.i for the codes).

(2) FAC-STAT-PCT. The distribution of the facilities listed among the categories: (i) undamaged or burned out; (ii) burning, stage 1; (iii) burning, stage 2; (iv) burning, stage 3; (v) burning, stage 4.

(3) FAC-DEBRIS. A single-digit code expressing the average amount of debris in the facilities listed (see B-H.2.j for the codes).

p. SHELTER SPACES

(1) SHEL-LVL-CODE. A single-digit code expressing whether shelter spaces listed are below ground (value = 1), lower stories (value = 2), or upper stories (value = 3).

(2) PF-DIST. The distribution of the shelter spaces listed by PF category (see B-H.3.k for the categories).

q. PERSONNEL

(1) INJ-CODE. A double-digit code expressing the type of injuries suffered by the personnel listed (see B-I.4.i for the codes).

(2) TRAPPED-PCT. The percentage of the personnel listed who are trapped (multiplies QUANTITY).

(3) INJ-PHASES. The injured people are subdivided into three groups (phases) depending upon their time of injury. The following variables occur in three sets, corresponding to the three phases:

(a) MEAN-TIME. The mean time at which people in the given phase were injured.

(b) MIN-TIME. The earliest time at which people in the given phase were injured.

(c) MAX-TIME. The latest time at which people in the given phase were injured.

(d) INJ-PERC. The percent of the injured people in the given phase (multiplies QUANTITY).

(4) MEAN-DOSE. The average accumulated dose (in tens of rads) for all people included on the record as of the beginning of the current period.

(5) MIN-DOSE. The smallest accumulated dose (in tens of rads) for all people included on the record as of the beginning of the current period.

(6) MAX-DOSE. The largest accumulated dose (in tens of rads) for all people included on the record as of the beginning of the current period.

C. Problem File

Four general classes of problems are encountered in this file. Each class has a different format. A brief description of these four major types of problems (i.e., Control, Increased Readiness, Damage, and Relief) and their formats are given below. Records of two or more classes exist for each land-use entry within a unit area. Control and readiness problems are always present.

1. PROB-TYPE-1 Record

Problems that relate to the ability to identify, locate, direct, coordinate, or otherwise control the civil defense system are identified as control problems. One example is the inability to inform people due to the disruptions of communication facilities. The format of the first problem type is shown in Table C-I, PROB-TYPE-1 FORMAT.

Table C-I

PROB-TYPE-1 FORMAT

COBOL Variable	COBOL Format	Remarks
ZONE-1	999	
AREA-1	999	
LUC-1	99	
OLD-NEW	9	Defines old or new record
CLASS-1	9	Defines transient or non-transient resources
PROB-CLASS	9	Code is "1"
UN-INFO	X	Not used, will be needed in communication submodels.
UN-PROB	X	
UN-ENVIRON	X	
RE-PROB	X	
UN-ASGN-RES		
TEAM-1	9(6)	
SPACES	9(6)	
CAP-UNITS-1	9(6)	Definition of capacity units vary from land use to land use.
EQUIP-SETS-1	9(6)	
RATIONS-1	9(6)	
WATER-1	9(6)	
FUEL-1	9(6)	
SUP-UNITS-1	9(6)	Definition of supply units vary from land use to land use.
FILLER	X(7)	

PROB-TYPE-1 Record, continued.

a. ZONE-1. The zone in which the unit area is located.

b. AREA-1. The unit area in which problem type-1 is located.

c. LUC-1. The identification number designating the land-use class of the unit area.

d. OLD-NEW. A code equal to 1 indicates old and 2 indicates new.

e. CLASS-1. A code equal to 0 indicates non-transient and 2 indicates transient.

f. PROB-CLASS. Code is 1, indicating a control problem.

g. UN-INFO. The uniformed public.

h. UN-PROB. Undefined problem.

i. UN-ENVIRON. Unknown environment.

j. RE-PROB. Unresolved problem.

k. UN-ASGN-RES. Unassigned resources in the respective land-use area.

(1) TEAM-1. The quantity of teams unassigned.

(2) SPACES-1. The quantity of shelter spaces unassigned

(3) CAP-UNITS-1. The quantity of capacity units unassigned.

(4) EQUIP-SETS-1. The quantity of equipment sets unassigned.

(5) RATIONS-1. The quantity of rations unassigned.

(6) WATER-1. The amount of water (gallons) unassigned.

(7) FUEL-1. The amount of heating fuel (gallons) unassigned.

(8) SUP-UNITS-1. The quantity of supply units unassigned.

2. PROB-TYPE-2 Record

Problems that relate to the vulnerability of people in a preattack situation or to personnel, facilities, and equipment by teams are readiness problems. The type-2 problem format is shown in Table C-II, PROB-TYPE-2 FORMAT.

Table C-II

PROB-TYPE-2 FORMAT

COBOL Variable	COBOL Format	Remarks
ZONE-1	X(10)	Same as 1
AREA-1		
LUC-1		
OLD-NEW		
CLASS-1		
PROB-CLASS	9	Code is 2
INOP-PERS	9(6)	
INOP-EQPT	9(6)	
INOP-VEH	9(6)	
INOP-FAC	9(6)	
INOP-SUP	9(6)	
FAC-DAM	9(6)	
EQPT-DAM	9(6)	
SHORTAGE	9(6)	
UNPRO-PEO	9(6)	
EQPT-EFF-FACTOR	9V99	
FILLER	X(2)	

a. ZONE-1. The zone in which the unit area is located.

b. AREA-1. The unit area in which problem type-2 is located.

c. LUC-1. The identification number designating the land-use class of the unit area.

d. PROB-CLASS. Code is "2", which indicates an increase readiness problem.

e. INOP-PERS. The personnel shortage which causes a team to be inoperative.

f. INOP-EQPT. The equipment shortage which causes a team to be inoperative.

g. INOP-VEH. The vehicle shortage which causes a team to be inoperative.

PROB-TYPE-2 Record, continued.

h. INOP-FAC. A facility shortage which causes a team to be inoperative.

i. INOP-SUP. The supply shortage which causes a team to be inoperative.

j. FAC-DAM. The number of facilities damaged in the problem area.

k. EQPT-DAM. The number of equipments damaged in the problem area.

l. SHORTAGE. The number of teams needed but are not available to solve this type of problem.

m. UNPRO-PEO. The total number of people in the problem area who are threantened, but no shelter is available to them.

n. EQPT-EFF-FACTOR. The efficiency of equipment which is damaged but not destroyed.

3. PROB-TYPE-3 Record

Damage control problems unlike other problem types prevent the loss of a resource or its utility rather than improving an already degraded condition. Examples of this type of problem include firefighting, decontamination, and debris clearing. The type-3 problem format is given in Table C-III, PROB-TYPE-3 FORMAT.

Table C-III

PROB-TYPE-3 FORMAT

COBOL Variable	COBOL Format	Remarks
ZONE-1		
AREA-1	X(10)	Same as 1
LUC-1		
OLD-NEW		
CLASS-1		
PROB-CLASS	9	Code is 3
PROB-SET-3	99	
NO-FAC-DAM	9(6)	
FAC-FIRE		
NO-IGN-3	9V99	
NO-AFLAME 1-3	9V99	
NO-AFLAME 2-3	9V99	
NO-BURNED-3	9V99	
AREA ASGN	9999V99	
NO-FAC-RAD	9(6)	
NO-FAC-3	9(6)	
FAC-DEBRIS	999	
FAC-RAD	9(5)V99	
LINK-DEBRIS	999	
LINK-JAM	9	
CHG-IND	X	
FILLER	X(6)	

PROB-TYPE-3 Record, continued.

a. ZONE-1. The zone in which the unit area is located.
b. AREA-1. The unit area in which problem type-3 is located.
c. LUC-1. The identification number designating the land-use class of the unit area.
d. OLD-NEW.
e. CLASS-1.
f. PROB-CLASS. Code is "3", which indicates a damage problem in the unit area.
g. PROB-SET-3.
h. NO-FAC-DAM. The number of facilities damaged in the problem area.
i. FAC-FIRE. The number of facilities afire, damaged, or destroyed in the problem area.
   (1) NO-IGN-3. The number of facilities that are ignited.
   (2) NO-AFLAME 1-3. The number of facilities that are burning but are not ignited.
   (3) NO-AFLAME 2-3. The number of facilities that are burning past peak intensity.
   (4) NO-BURNED-3. The number of facilities that have been damaged or destroyed by fire. (The fire has been extinguished or has burned out.)
j. AREA-ASGN. Total area assigned.
k. NO-FAC-RAD. The number of facilities with the radiation level (FAC-RAD).
l. NO-FAC-3. The total number of facilities in the area.
m. FAC-DEBRIS. The debris level.
n. FAC-RAD. The radiation level.
o. LINK-DEBRIS. THe debris level on streets.
p. LINK-JAM. The number of links not passable because of traffic jams.
q. CHG-IND

4. PROB-TYPE-4 Record

This leading class of problems, which relates directly to the state of people, consists of shelter, rescue, treatment, and rehabilitation problems. It sets the standard for measuring the degree to which human life has been disrupted. All other problem groups must relate to this one and in this sense are subordinate to it. The format for type-4 problem is given in Table C-IV, PROB TYPE-4 FORMAT.

Table C-IV

PROB-TYPE-4 FORMAT

COBOL Variable	Format	Remarks
ZONE-1		
LUC-1		
OLD-NEW	X(10)	Same as 1
CLASS-1		
PROB-CLASS	9	Code is 4
PROB-SET	99	See Appendix C Table C-XIII
QTY-PEOPLE	9(6)	
PHASE-CODE	9	
CAS-TYPE	V99	Occurs 15 times
MEAN-TIME-OF-INJ	99V9	
TIME-OF-INJ (MIN)	99	
TIME-OF-INJ (MAX)	99	
MEAN CAS-DOSE	99V9	
CAS-DOSE (MIN)	999	
CAS-DOSE (MAX)	999	
CD-CAS-CODE		

a. ZONE-1. The zone in which the unit area is located.

b. AREA-1. The unit area in which problem type-4 is located.

c. LUC-1. The identification number designating the land-use class of the unit area.

d. OLD-NEW

e. CLASS-1 See Table B-I

f. PROB-CLASS. Code is "4", which indicates there is a relief problem in the unit area.

g. PROB-SET. The identification number for the problem set.

PROB-TYPE-4 Record, continued.

h. QTY-PEOPLE. The number of people in the problem area.

i. The phase of the prognosis - change period in which the injuries listed fall.

j. CAS-TYPE. The casualty distribution of the problem area. There are three levels respectively (moderate, severe, and mortal) of each of the following; blast, thermal, nuclear, fire, and fallout. There is one undefined type.

k. MEAN-TIME-OF-INJ. The average time at which the injuries listed on the record occurred.

l. TIME-OF-INJ (MIN) & TIME-OF-INJ (MAX). The minimum and maximum times at which injuries listed on this record occurred.

m. MEAN-CAS-DOSE. The average dose of the casualties listed on this record.

n. CAS-DOSE (MIN) and CAS-DOSE (MAX). The minimum and maximum dosages of the casualties listed on this record.

o. CD-CAS-CODE. Code which distinguishes between civil defense and non-civil defense population.

(1) non-civil defense

(2) civil defense

D. Resource-File

The format for the file is shown in Table D-I, RESOURCE DATA FORMAT.

Table D-I

RESOURCE DATA FORMAT

COBOL Variable	COBOL Format	Remarks
PART-1		
ZONE-ID-2	X(3)	
AREA-ID-2	X(3)	
LUC-CODE-2	99	
FILLER	X	
CLASS-2	9	
ENVIRON-CLASS	9	
PART-2		
PART-2A		
BOS	9	
TOTAL-AREA-2	999V99	
NO-STRUC	9(6)	
TOTAL-TOTAL	9(6)	
CD-FORCE	9(6)	
TOTAL-UNINJ	9(6)	
RESOURCES		
RESOURCE	9(6)	Occurs 8 times
REFUGEES	9(6)	
PROB-CD	9(6)	
PROB-NCD	9(6)	
TOTAL-DEAD-1	9(6)	
CD-DEAD	9(6)	
CD-POSTURE	99	
AVG-UNINJ-DOSE(NCD)	999V9	
AVG-UNINJ-DOSE(CD)	999V9	

1. PART-1

   a. ZONE-ID-2. The zone in which the unit area is located.

   b. AREA-ID-2. An identification of the location of the resources.

   c. LUC-CODE-2. The identification number designating the land-use class of the unit area.

   d. CLASS-2. A code which indicates whether the supplies belong to this LUC or are transient:

      (1) non-transient

      (2) transient

Resource-File, continued.

e. ENVIRON-CLASS. A code denoting the set of fire, radiation, and debris levels existing in that UA (i.e., equivalent to BOS designations used in ALFA NEOP).[D-1/]

2. PART-2

a. PART-2A

(1) BOS. The level of environment.

(2) TOTAL-AREA-2. The total area of the resource location in square miles.

b. NO-STRUC. The number of structures in the unit area.

c. TOTAL-TOTAL. The total number of people in the unit area.

d. CD-FORCE. The total number of civil defense people in the unit area.

e. TOTAL-UNINJ. The total number of uninjured people in the unit area.

f. RESOURCES. The eight resources are teams, spaces, capacity units, equipment sets, rations, water, fuel, and supply units.

g. REFUGEES. The number of refugees from other unit areas to this unit area.

h. PROB-CD. The number of injured CD people.

i. PROB-NCD. The number of injured non-CD people.

j. TOTAL-DEAD-1. The total number of dead people.

k. CD-DEAD. The total number of dead CD people.

l. CD-POSTURE. The level of protection for CD personnel.

(1) Unwarned

(2) Warned

(a) Duck for cover

(b) Sheltered-fallout

(c) Sheltered-blast

m. AVG-UNINJ-DOSE(NCD) and AVG-UNINJ-DOSE(CD). The average dose of uninjured people, non-CD and CD, respectively.

D-1/ ALFA NEOP, EOC Master Check List (Zonal Level). Washington, D.C.: Department of Defense, Office of Civil Defense, FG G-1.2/2, April 1971.

E. Organization File

The format for the file is given in Table E-I, ORGN-RECORD FORMAT.

Table E-I

ORGN-RECORD FORMAT

COBOL Variable	COBOL Format	Card Columns	Remarks
FILLER	X	1	
ORGN-AREA	9(3)	2-4	
FILLER	XX	5-6	
ORGN-DATA	X(8)	7-14	Divided into four parts:
		(7-8)	Zone number.
		(9-10)	EOC number.
		(11-12)	Group number.
		(13-14)	Sector number.
ORGN-SERV	99	15-16	

1. ORGN-AREA. The identification number of the unit area.
2. ORGN-DATA. The organization number is divided into four parts (i.e., Zone, EOC, Group, and Sector).
3. ORGN-SERV. The identification number of the service to which a team belongs (i.e., there are ten types):
   a. 1 indicates headquarters.
   b. 2 indicates welfare.
   c. 3 indicates medical.
   d. 4 indicates fire.
   e. 5 indicates police.
   f. 6 indicates rescue.
   g. 7 indicates engineering.
   h. 8 indicates transportation.
   i. 9 indicates communication.
   j. 10 indicates supply.

F. Service File

The format for the file is shown in Table F-I, SERV-RECORD FORMAT.

Table F-I

SERV-RECORD FORMAT

COBOL Variable	COBOL Format	Remarks
ADDRESS-11		
ORGN-11		
ZONE-11	99	
EOC-11	99	
GROUP-11	99	
SECTOR-11	99	
SERVICE-11	99	
AREA-ID-11	X(6)	
TEAM-ID-11	99	
NO-TEAMS-11	9(6)	
SECTOR-ENVIRON	9	Occurs 9 times.
FILLER	X(15)	
STATE-DISTRB		
PCT-BY-STATE	V999	Occurs 8 times.
NO-FUNC-11	99	
TEAMS-FORCE	9(5)V9	
TEAMS-LOST	9(5)V9	
SUM-RES		
RES-SUM	9(6)	Occurs 8 times.

1. ADDRESS-11

   a. ORGN-11. The organization number.

      (1) ZONE-11. Zone identification number.

      (2) EOC-11. EOC identification number.

      (3) GROUP-11. Group identification number.

      (4) SECTOR-11. Sector identification number.

   b. SERVICE-11. Service identification number. (See in this appendix, Section E, Organization File, part 3.)

   c. AREA-ID-11. Unit-area identification number.

Service File, continued.

2.	TEAM-ID-11	Team type identification code.
3.	NO-TEAMS-11	Number of teams of type specified above.
4.	SECTOR-ENVIRON	BOS numbers encountered in each sector.
5.	STATE-DISTRB	Percent of teams for each of 8 states.
6.	NO-FUNC-11	Function to which teams are currently assigned.
7.	TEAMS-FORCE	Total teams in work force.
8.	TEAMS-LOST	Number of teams deactivated.
9.	SUM-RES	Amount of resources currently assigned to work force.

AD-A050 292 RESEARCH TRIANGLE INST RESEARCH TRIANGLE PARK N C F/G 15/6
STUDY TO DEVELOP A DAMAGE ESTIMATION SYSTEM FOR IN-HOUSE STUDIE--ETC(U)
SEP 77 R N HENDRY, R O LYDAY, T W DELLA DCPA01-76-C-0333
UNCLASSIFIED RTI-1358/F01 NL

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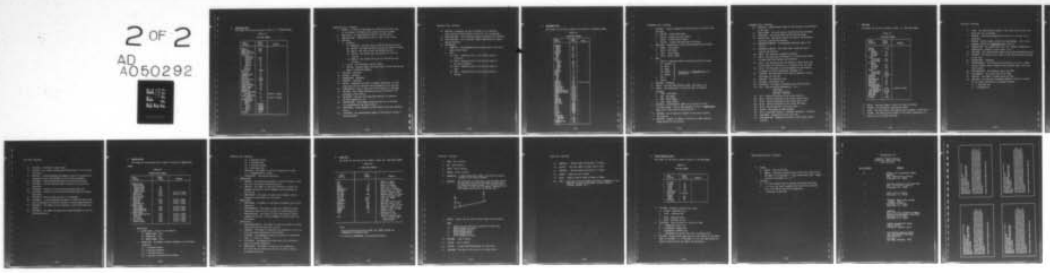

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G. Operations File

The format for the file is shown in Table G-I, OPS-DATA FORMAT.

Table G-I

OPS-DATA FORMAT

COBOL Variable	COBOL Format	Remarks
ORGN-10	X(8)	
AREA-ID-10	X(6)	
AREA-LINK-CODE	X	
OPS-ID-10		
ID-OPS-10		
ORIGIN-10	X(6)	
OPS-LUC	99	
SEQ-10	99	
TYPE-10	9	
CODE-10	99	
ALT-10	9	
SEQ-10A	9	
ORIG-TIME	999V9	
DC-CODE	X	
PROBLEM-CODE	99	
STATUS-10	X	
OPS-QTY	9(6)	
START-TIME-10	999V9	
OPS-CODE	999	
OPS-STATUS	X	
COMP-OPS-CODE	999	
COMP-STATUS	X	
LIMIT-FUNC	XX	
BEN-TYPE	X	
TOTAL-FUNC-SET1		
OP-FUNC	99	Occurs 12 times.
TOTAL-FUNC-SET2		
OP-FUNC2	99	Occurs 12 times.
OPS-PRIORITY		
RANK-OPS	9	
OPS-N		
OPS-1	9V9999	
OPS-2	9V9999	
OPS-3	9V9999	
OPS-4	9V9999	
FILLER	X(11)	

Operations File, continued.

1. ORGN-10. A field that designates the location of the unit area by zone number, EOC number, group number, and sector number.
2. AREA-ID-10. The identification number of the unit area.
3. AREA-LINK-CODE. Identification code for link or area record.
4. OPS-ID-10
   a. ID-OPS-10
      (1) ORIGIN-10. The unit area in which the problem occurred.
      (2) OPS-LUC. The land-use class in which the problem occurred.
      (3) SEQ-10. The time in which the problem occurred.
      (4) TYPE-10. The problem type (see Section C) which has occurred.
      (5) CODE-10. The identification of the problem which has occurred.
   b. ALT-10. The alternative solution number.
   c. SEQ-10A. Sequence number used where there is more than one move made in solving the problem.
5. ORIG-TIME. Undefined.
6. DC-CODE. Undefined.
7. PROBLEM-CODE. Undefined.
8. STATUS-10. Undefined.
9. OPS-QTY. Designates the number of people, structures, or other items acted upon by functions being performed in this operation.
10. START-TIME-10. Hour in which the initial function is performed.
11. OPS-CODE. Table number designating the set of functions to be performed at the location.
12. OPS-STATUS. The code which designates whether the operation has been completed or not.
13. COMP-OPS-CODE. Table number designating the set of functions to be performed at some other location.
14. COMP-STATUS. States whether the above function has been completed or not.
15. LIMIT-FUNC. The identification number of the function currently being performed.

Operation File, continued.

16. BEN-TYPE. Designates the type of benefit (i.e., survivors, labor potential (health level of survivors), job, or housing).
17. TOTAL-FUNC-SET1. Set of function numbers describing the operation.
18. TOTAL-FUNC-SET2. Set of function numbers describing the complementary operation.
19. OPS-PRIORITY
    a. RANKS-OPS. Code designating the priority given to the four major problem types.
    b. OPS-N
        (1) OPS-1. Numerical value of the priority given to survivors.
        (2) OPS-2. Numerical value of the priority given to the labor potential.
        (3) OPS-3. Numerical value of the priority given to jobs.
        (4) OPS-4. Numerical value of the priority given to housing.

H. Assignment File

The format for the file is shown in the Table H-I, ASGN-DATA FORMAT.

Table H-I

ASGN-DATA FORMAT

COBOL Variable	COBOL Format	Remarks
CUR-ADRS		
CUR-OBE	XX	
CUR-UA	XX	
CUR-SA	XX	
CUR-LUC	99	
DEST-ADRS		
ZONE-4	99	
EOC-4	99	
GRP-4	99	
SEC-4	99	
OPN-4		
OPN-4-1		
ORIGIN-4	X(6)	
LUC-4	99	
SEQ-4	99	
TYPE-4	0	
CODE-4	99	
ALT-4	9	
SEQ-4A	9	
NEW-ADRS	9	
TEAM-4	99	
ORGN-4		
ZONE	99	
EOC	99	
GRP	99	
SEC	99	
SERVICE-4	99	
RES-ASGN	9(6)	Occurs 8 times
ASGN-QTY	9(6)	
FUNC-NO-4	99	
TIME-IN-FUNC	9(3)V9	
START-TIME	9(3)V9	
ARRIVAL-TIME	9(3)V9	
COMPLETION-TIME-EST	9(3)V9	
COMPLETION-TIME-ACT	9(3)V9	
THR-M	9(3)V9	
THR-I	9(3)V9	
THR-R	9(3)V9	
THR-O	9(3)V9	
PREP-THR	9(3)V9	
PROD-THR	9(3)V9	
BEN-CODE	XX	
NO-POT-BEN	9(6)	
IP-4	99V99	
SP-4	V9999	
SP-41	V9999	
SP-42	V9999	
SP-43	V9999	
SP-44	V9999	
NO-ASGN	999	
FP-4	99	
AREA-ADRS2		
ZONE-ADRS	999	
AREA-ADRS3	999	
FILLER	X(26)	
ASGN-PRIOR-SEQ	99	
FILLER	X(5)	

Assignment File, continued.

1. CUR-ADRS. Current organization identification of the area being processed.
   a. CUR-OBE. Current OBE number.
   b. CUR-UA. Current unit area number.
   c. CUR-SA. Current sector number.
   d. CUR-LUC. Current land-use class of the area.
2. DEST-ADRS. Organization to which the destination area belongs.
   a. ZONE-4. Zone number.
   b. EOC-4. EOC number.
   c. GRP-4. Group number.
   d. SEC-4. Sector number.
3. OPN-4
   a. OPN-4-1. Operation number to which the function belongs.
      (1) ORIGIN-4.
      (2) LUC-4.
      (3) SEQ-4.
      (4) TYPE-4.
      (5) CODE-4.

      See Section C, Operations File, for definitions.
   b. ALT-4.
   c. SEQ-4A.
4. NEW-ADRS. Undefined.
5. TEAM-4. The team identification number (see Table C-II).
6. ORGN-4. The organization to which the team is currently assigned.
   a. ZONE. Zone number.
   b. EOC. EOC number.
   c. GRP. Group number.
   d. SEC. Sector number.
7. SERVICE-4. Identification number of the service to which the team belongs. (See in this appendix, Section H, Organization File, part 3 for a list of these services.)
8. RES-ASGN. Set of resources required by the team to perform the function.
9. ASGN-QTY. Quantity of people, facilities, or other resources being affected by the function.

Assignment File, continued.

10. FUNC-NO-4. Identification number of the function to be performed by the team.
11. TIME-IN-FUNC. The total hours a function has been performed.
12. START-TIME. The time at which the function was begun.
13. ARRIVAL-TIME. The arrival time of the team at the designated location to perform the function.
14. COMPLETION-TIME-EST. The estimated completion time of the function.
15. COMPLETION-TIME-ACT. The actual time it took the team to complete the function.
16. THR-M. The team hours consumed in movement.
17. THR-I. The time spent in waiting by the team for some reason or other before the function was performed.
18. THR-R. The restricted time the team had to wait before they could perform the function (e.g., radiation level too high).
19. THR-O. The time spent by the team because of the inability to operate for lack of personnel, equipment, etc.
20. PREP-THR. The time spent by the team in preparation before performing the function.
21. PROD-THR. The production time.
22. BEN-CODE. The benefit code.
23. NO-POT-BEN. The number of benefits that will be derived.
24. IP-4. Initial priority designation. (i.e.,

$$\frac{\text{NO-POT-BEN}}{\text{PREP-THR + PROD-THR}}$$

25. SP-4. Service priorities at the current location.
26. SP-41. Service priorities at the current sector level.
27. SP-42. Service priorities at the current group level.
28. SP-43. Service priorities at the current EOC level.
29. SP-44. Service priority at the zone level.
30. NO-ASGN. The number of teams assigned.
31. FP-4. Functional Priority -- assigned externally, if desired.
32. AREA-ADRS2. Designated zone and unit area.
33. ASGN-PRIOR-SEQ. Preserves the priority order during sorting routines.

I. Trip File

The format for the file is shown in Table I-I, TRIP-DATA FORMAT.

Table I-I

TRIP-DATA FORMAT

COBOL Variable	COBOL Format	Remarks
OPN-NO	X(15)	
ID-ORGN		
FILLER	XX	
ID-D-EOC	99	
FILLER	X(4)	
ID-NO		
ID-NO-ZONE	9(3)	
ID-NO-AREA	9(3)	
IO-ORGN		
FILLER	X	
ID-O-EOC	99	
FILLER	X(4)	
IO-NO		
IO-NO-ZONE	9(3)	
IO-NO-AREA	9(3)	
PRIORITY	99999	
SERVICE	9$	
DISTRIB-CODE	X	
TRIP-TEAM	99	
FUNCTION	99	
SUPPORT-FUNC	99	
TRIP-RESOURCES		
TRIP-RES	9(6)	Occurs 8 times.
TRIP-DEPARTURE	9(3)V9	
TRIP-ARRIVAL	9(3)V9	
TRIP-QTY	9(6)	
MOB-CODE	9	
FILLER	X(66)	

1. OPN-NO. Operation number to which the function belongs.
2. ID-ORGN. The destination organization number.
3. ID-NO. The zone and unit area identification numbers of destination.
4. IO-ORGN. The identification number of the origin organization for which the trip is being performed.

Trip File, continued.

5. IO-NO. The identification number of the origin zone and unit area where the trip is starting.
6. PRIORITY. Code which designates the priority of the trip to be performed.
7. SERVICE. Service number to which the team belongs. (See in this appendix, Section H, Organization File, part 3.)
8. DISTRIB-CODE. The network code (e.g., may indicate transportation, communication, sewage, or power lines, etc.).
9. TRIP-TEAM. The identification number of the team performing the trip.
10. FUNCTION. The identification number of the function being performed by the team.
11. SUPPORT-FUNC. Undefined.
12. TRIP-RESOURCES. The resources being moved (up to 8, i.e., teams, spaces, capacity units, equipment sets, rations, water, fuel, and supply units).
13. TRIP-DEPARTURE. The departure time of the team.
14. TRIP-ARRIVAL. The arrival time of the team.
15. TRIP-QTY. The number of teams taking the trip.
16. MOB-CODE. The code which designates whether a vehicle is needed by the team in performing its assigned function.
    a. 1 indicates yes.
    b. 0 indicates no.

J. History File

The format for the history file is shown in Table J-I, HISTORY-RECORD.

Table J-I

HISTORY-RECORD

COBOL Variable	COBOL Format	Remarks
PRINT-DATA	X(132)	
PRINT-CODE	9	Indicates the type of record below 1 - Operations 2 - Assignment 3 - Trip
Operation Printout		(see Operation File for explanation of fields)
FILLER	XXX.	
PRINT-OPS-ORGN	X(9).	
PRINT-AREA-ID-10	X(6).	
PRINT-LINK-CODE	X.	
FILLER	XX.	
PRINT-CURRENT-AREA	X(7).	
PRINT-LAND-USE	ZZ9.	
FILLER	X.	
PRINT-TYPE-10	X(11).	
PRINT-START-TIME-10	ZZZ9.	
PRINT-PROBLEM-CODE	ZZZ9.	
FILLER	XXX.	
PRINT-OPS-SET	.	occurs 12 times
PRINT-OP-FUNC	99.	
FILLER	X.	
PRINT-CUR-ASGN	Z99.	
FILLER	X.	
PRINT-OPS-1	ZZZ9.9.	
PRINT-OPS-2	ZZZ9.9.	
PRINT-OPS-3	ZZZ9.9.	
PRINT-OPS-4	ZZZ9.9.	
PRINT-OPS-QTY	Z(7)9.	
PRINT-END-TIME	Z(4)9.9.	

History File, continued.

COBOL Variable	COBOL Format	Remarks
Assignment Print-Out		(see Assignment File for explanation of fields)
PRINT-ASGN-ORGN	X(9).	
PRINT-ASGN-ORIGIN	X(7).	
PRINT-ASGN-AREA	X(7).	
PRINT-ASGN-LAND-USE	Z9.	
FILLER	XX.	
PRINT-ASGN-TYPE	X(11).	
PRINT-ASGN-PERIOD	Z99.	
PRINT-ASGN-NO	Z99.	
PRINT-ASGN-SEQ	Z99.	
FILLER	XX.	
PRINT-ASGN-FUNC	X(13).	
PRINT-ASGN-TEAM	X(14).	
PRINT-RESOURCE-SET2		Occurs 8 times
FILLER	X.	
PRINT-RESOURCES-USED	9(6).	
PRINT-NO-ASGN	ZZZ9.	
PRINT-XHRS-PREP	Z(5)9.9.	
PRINT-XHRS-PROD	Z(5)9.9.	
FILLER	X.	
PRINT-BAL-PREP	Z(5)9.9.	
PRINT-BAL-PROD	Z(5)9.9.	
FILLER	X.	
PRINT-BENEFIT-TYPE	X(8).	
PRINT-ACTUAL-BENEFITS	Z(6)9.	
PRINT-BAL-BENEFITS	Z(6)9.	
Trip Print-Out		(see Trip File for for explanation of fields)
PRINT-LV	ZZZ.9.	
PRINT-AR	ZZZZ.9.	
FILLER	X.	
PRINT-TYPE	X.	
PRINT-ORIGIN	Z(4).	
PRINT-O-LUC	Z(3).	
PRINT-DESTI	Z(4).	
PRINT-D-LUC	Z(3).	
FILLER	X.	
PRINT-OPN	X(13).	
FILLER	X.	
PRINT-TEAM	X(13).	
PRINT-NUM	ZZZ9.	
PRINT-PRIORITY	Z(6).	
PRINT-PEOPLE	Z(7).	
PRINT-FOOD	Z(7).	
PRINT-DRINK	Z(7).	
PRINT-WATER	Z(7).	
PRINT-FUEL	Z(7).	
PRINT-MED-PKGS	Z(7).	
PRINT-GAS	Z(7).	
PRINT-POWER	Z(7).	
PRINT-PARTS	Z(7).	
PRINT-PCT	Z(4).	

K. Performance File

The format for the performance file is shown in Table K-I, PERFORMANCE-RECORD.

Table K-I

PERFORMANCE-RECORD

COBOL Variable	COBOL FORMAT	Remarks
TEAM-ZONE	99	
TEAM-EOC	99	
TEAM-AREA	999	
TEAM-NO.	99	
NO-OF-TEAMS	9(6)	occurs 3 times
TEAM-HOURS	9(8)	
TEAM-HOUR-GAIN	9(8)	
TEAM-HOUR-LOSS	9(8)	
TEAM-HOUR-DEMAND	9(8)	
TEAM-HOUR-STATE	9(8)	occurs 9 times
FILLER	X(4)	
RECORD-PERIOD	99	
RECORD-TYPE*	X	0 or 1

*Note - When RECORD-TYPE is "1" the record is redefined as a Benefit-Record (see BENEFIT-FILE).

1. TEAM-ZONE. Zone location.
2. TEAM-EOC. EOC location.
3. TEAM-AREA. Area location.
4. TEAM-NO. Identification of team by type.
5. NO-OF-TEAMS. Total number of teams in unit area of specified type.
6. TEAM-HOURS. Total potential team-hours.
7. TEAM-HOURS-GAIN. Team-hours gained during period.
8. TEAM-HOURS-LOSS. Team-hours lost during period.
9. TEAM-HOURS-DEMAND. Team-hours needed to solve problems.
10. TEAM-HOURS-STATE. Amount of hours in each of 9 possible states.
11. RECORD-PERIOD. Time period.
12. RECORD-TYPE. Either team readiness or benefit data as indicated above.

L. Plot File

The format for the plot file is shown in Table L-I, PLOT-DATA FORMAT.

Table L-I

PLOT-DATA FORMAT

COBOL Variable	COBOL Format	Remarks
PLOT-ZONE	99	
PLOT-EOC	99	
PLOT-AREA	999	
PLOT-PERIOD	99	
PLOT-TIME	999V9	
PLOT-POP	9(6)	
PLOT-COST	9(8)	
PLOT-RWB-PRICE	999V99	
PLOT-RDY-PRICE	999V99	
PLOT-NORM	9V999	
PLOT-PROB	9V999	
PLOT-LOST	9V999	
PLOT-RWB	9V999	
PLOT-RDY	9V999	
PLOT-RWB-S	9V999	
PLOT-RWB-L	9V999	
PLOT-RWB-J	9V999	
PLOT-RWB-H	9V999	
PLOT-RDY-S	9V999	
PLOT-RDY-L	9V999	
PLOT-RDY-J	9V999	
PLOT-RDY-H	9V999	

1. PLOT-ZONE. Zone location.
2. PLOT-EOC. EOC location.
3. PLOT-AREA. Area location.
4. PLOT-PERIOD. Interval for a given pass.
5. PLOT-TIME. Time in hours at the end of the PLOT-PERIOD.
6. PLOT-POP. Surviving population plus the dead.
7. PLOT-COST. Cost in team hours.
8. PLOT-RWB-PRICE. Team hours for a unit of well-being.
9. PLOT-RDY-PRICE. Team hours of readiness.
10. PLOT-NORM. Normal population.
11. PLOT-PROB. Problem population.

Plot File, continued.

12. PLOT-LOST. The number of people dead.
13. PLOT-RWB. The current average relative-well-being of the surviving population.
14. PLOT-RDY. A value expressing the degree to which the resources are available to solve the problems of the surviving population.
15. PLOT-RWB-S. The surviving population for relative-well-being.
16. PLOT-RWB-L. Fraction denoting labor potential of the surviving population.
17. PLOT-RWB-J. Fraction of the surviving population with jobs.
18. PLOT-RWB-H. Fraction of the surviving population who have housing facilities.
19. PLOT-RDY-S. The surviving population for readiness.
20. PLOT-RDY-L. A value expressing the degree to which the labor potential is available to solve the problems of the surviving population.
21. PLOT-RDY-J. The number of jobs available to solve the problem population.
22. PLOT-RDY-H. The number of housing facilities available to solve the problem population.

M. Benefits File

The format for the benefits file is shown in Table M-I, BENEFIT-DATA FORMAT.

Table M-I

BENEFIT-DATA FORMAT

COBOL Variable	COBOL Format	Remarks
BENEFIT-REC1		
BENEFIT-ORGN		
BENEFIT-ZONE	99	
BENEFIT-EOC	99	
BENEFIT-AREA	999	
BENEFIT-POP	9(6)	Occurs 10 times.
THRS-AVAIL	9(8)	Occurs 5 times.
PREVIOUS-POP	9(6)	
BENEFIT-REC2		
THRS-DEV	9(8)	Occurs 5 times.
THRS-PRO	9(8)	Occurs 4 times.
THRS-PRO-DEV	9(8)	Occurs 4 times.
BENEFIT-REC3		
THRS-DEMAND	9(8)	Occurs 5 times.
THRS-DEMAND-DEV	9(8)	Occurs 5 times.
THRS-DEMAND-PRO	9(8)	Occurs 4 times.
BENEFIT-REC4		
THRS-DEMAND-PRO-DEV	9(8)	Occurs 4 times.
TEAMS-DEV	9(6)	Occurs 5 times.
FAC-AVAIL	9(6)	Occurs 3 times.
FAC-AT-RISK	9(6)	Occurs 3 times.
TEAMS-PRO-DEV	9(6)	Occurs 3 times.

1. BENEFIT-REC1

   a. BENEFIT-ORGN. Location of the benefits.

      (1) BENEFIT-ZONE. Zone.

      (2) BENEFIT-EOC. EOC.

      (3) BENEFIT-AREA. Area.

   b. BENEFIT-POP. The number of people assigned to the following categories:

      (1) 1 indicates housed.

      (2) 2 indicates employed.

      (3) 3 indicates healthy.

      (4) 4 indicates survivors with a problem.

Benefits File, continued.

(5) 5 indicates control.

(6) 6 indicates dead.

(7) 7 indicates problem.

(8) 8 indicates total.

c. THRS-AVAIL. The number of team hours available for codes 1 - 5 in BENEFIT-POP (b. above).

d. PREVIOUS-POP. The previous population.

2. BENEFIT-REC2

a. THRS-DEV. The team hours assigned to reclaim inoperative teams for use in serving the problem population.

b. THRS-PRO. The number of team hours available to protect undamaged facilities or restore damaged facilities during the next period.

c. THRS-PRO-DEV. The number of team hours assigned to reclaim inoperative teams during the next period.

3. BENEFIT-REC3

a. THRS-DEMAND. The number of team hours in demand by the problem population.

b. THRS-DEMAND-DEV. The number of team hours needed to reclaim inoperative teams for use in serving the problem population.

c. THRS-DEMAND-PRO. The number of team hours needed to protect undamaged facilities or restore damaged facilities during the next period.

4. BENEFIT-REC4

a. THRS-DEMAND-PRO-DEV. The number of team hours needed to reclaim inoperative teams during the next period.

b. TEAMS-DEV. The number of teams that are inoperative but who can serve the problem population if reactivated.

c. FAC-AVAIL. The undamaged facilities available for BENEFIT-POP codes 1 - 3 (see 1.b. above).

d. FAC-AT-RISK. The damaged facilities which can be restored to serve the problem population.

e. TEAMS-PRO-DEV. The number of teams that are inoperative but can be used to restore facilities to be used in serving the problem population.

N. Links File

The format for the links file is shown in Table N-I, LINKS DATA FORMAT.

Table N-I

LINKS DATA FORMAT [1]

COBOL Variable	COBOL Format	Remarks
ZONE	9	ZONE i.d. number
EOC	9	EOC i.d. number
GROUP	99	Group i.d. number
SECTOR	99	Sector i.d. number
NETWORK-NO [2]	999	Unit Area i.d. number
FWD-NODE	999	Forward node i.d. number
LVL FOR	x	Level of forward node
BWD-NODE	999	Backward node i.d. number
LVL BAC	x	Level of backward node
LINK-NO	9999	Link i.d. number
LINK-NAME	x(11)	Link name
UA-NO-L	999	Unit area, left of link
NTWK-NO-L	999	Network, left of link
UA-NO-L	999	Unit area, right of link
NTWK-NO-R	999	Network, right of link
LENGTH	9V9	Length of link in miles
WIDTH	9	Width of link
TYPE	XX	Use-type of link
		Direction of link
none		Room for further expansion; variables for queuing model

Notes:

[1] This file should be sorted by ZONE, EOC, GROUP, SECTOR, and NETWORK-NO in ascending order.

[2] A record with NETWORK-NO = 999 separates networks.

Links File, continued.

1. ZONE. Zone location.

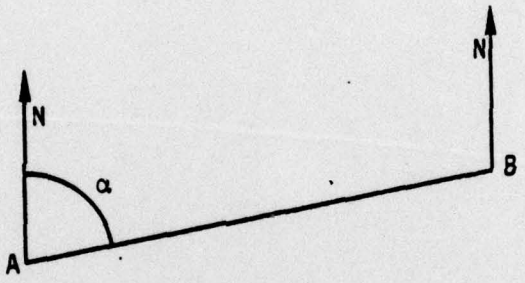
2. EOC. EOC location.

3. GROUP. Group location.

4. SECTOR. Sector location.

5. NETWORK-NO. A unique heirarchical number reflecting the network position in the overall network.

6. FWD-NODE. The definition is illustrated in the following diagram for two nodes A and B and illustrates the definition of forward and backward nodes. The indicated angle, α, about node A is less than 180 degrees, therefore, A is the backward node and B is the forward node.



7. LEVFOR. Level codes are used to define higher level networks.

Code

1	Interior to unit area or not shared with other areas
2	Shared between unit areas
3	Shared between sectors
4	Shared between groups
5	Shared between FOC's
6	On the boundary of zones

8. BWD-NODE. (see 6. above)

9. LEV BAC. (see 7. above)

10. LINK-NO. A unique identifying number for each link.

11. LINK-NAME. The name for the artery in the target area.

Links File, continued.

13. NTWK-NO-L. Network number pertaining to 12 above.

14. UA-NO-R. Unit area number on right side of link.

15. NTWK-NO-R. Network number pertaining to 14 above.

16. Length. Length of link in miles.

17. Width. Width of link in terms of number of lanes.

18. Type. Use-type of link (currently restricted to highways but type codes will be used to distinguish between highways, railways, seaways, etc.)

O. Travel Reference File

The format for the file is shown in Table O-I, TVL-REF FORMAT.

Table O-I

TVL-REF FORMAT

COBOL Variable	COBOL Format	Remarks
TVL-ORGN		
R-ZONE	99	
R-EOC	99	
R-GRP	99	
R-SEC	99	
LEVEL-CODE	9	
TVL-TIME	9(2)V99	
R-AREA		
AREA-Z	999	
AREA-R	999	
TVL-CODE	X	

1. TVL-ORGN. Reference identification number.
   a. R-ZONE. Reference zone.
   b. R-EOC. Reference EOC.
   c. R-GRP. Reference group.
   d. R-SEC. Reference sector.
2. LEVEL-CODE. Gives the level of location of data.
   a. 1 designates an EOC area.
   b. 2 designates a GROUP area.
   c. 3 designates a SECTOR area.
   d. 4 designates the nearest unit area in adjacent EOC's.
3. TVL-TIME. Average travel time within an area defined by the LEVEL-CODE, if TVL-CODE = 1. If TVL-CODE = 3, it's the time between two specific points such as the origin and destination.

Travel Reference File, continued.

4. R-AREA
   a. AREA-Z. Zone of the area.
   b. AREA-R. Indicates the area within the EOC (the origin area if TVL-CODE = 2; if TVL-CODE = 3, then a destination area. AREA-R is blank if TVL-CODE = 1 or 4).
5. TVL-CODE.
   a. 1 is the indicator used to generate the nearest EOC table.
   b. 2, 3, and 4 are used to generate the travel table (pertains only to the EOC at that time of execution).
   c. 4 indicates the EOC area.

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Final Report 440-1350 DCPA Work Unit 4126I
DCPA Contract No. DCPA01-76-C-0333
<u>Study to Develop a Damage Estimation System for In-House Studies</u>
Hendry, R. N., R. O. Lyday, Jr., T. W. Bello, and R. J. Reeves
September 1977 (UNCLASSIFIED)
113 pages

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SIMULATION, SYSTEM EVALUATION, FILE MANAGEMENT, OVERLAY STRUCTURE, MODEL

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